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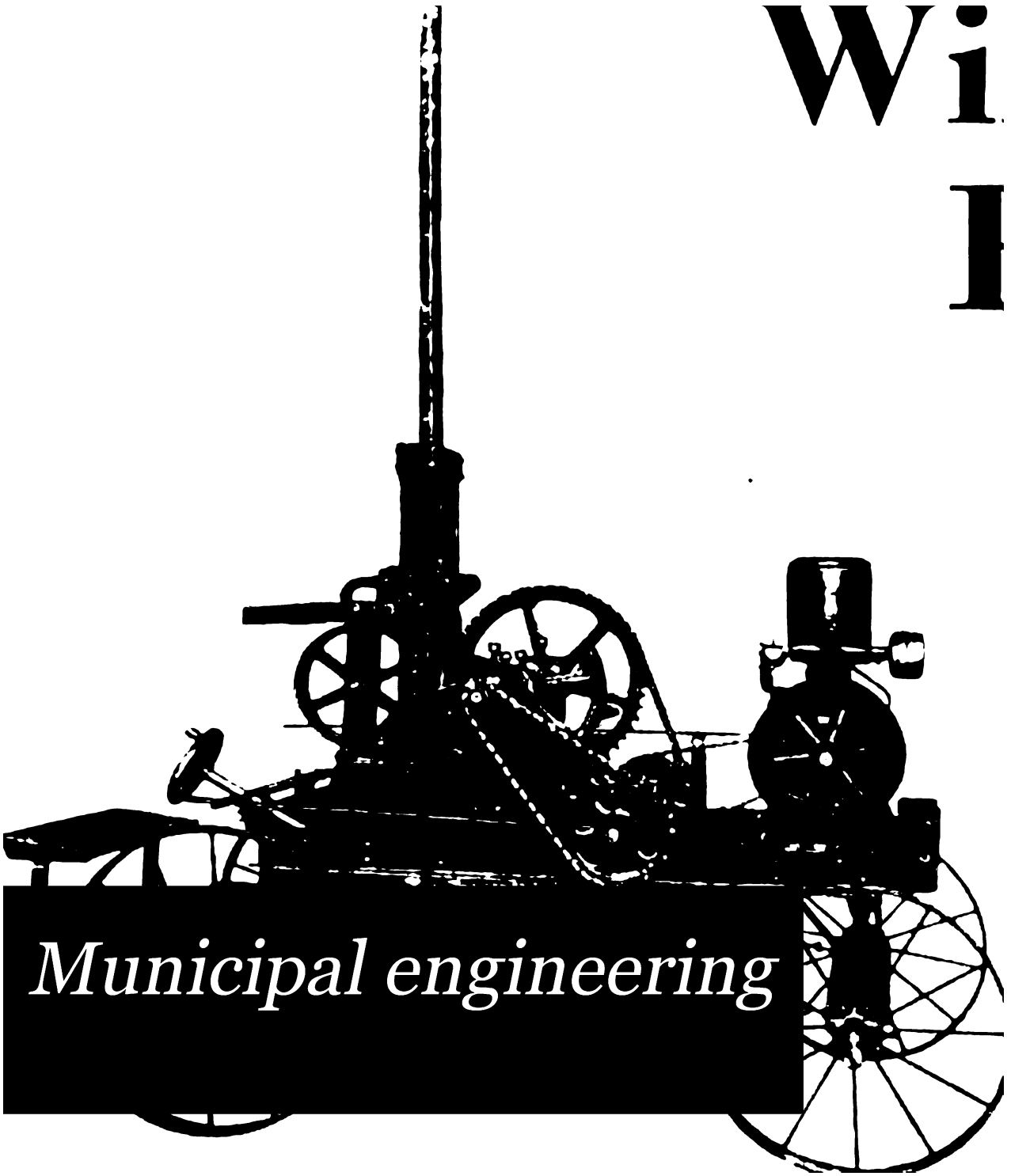

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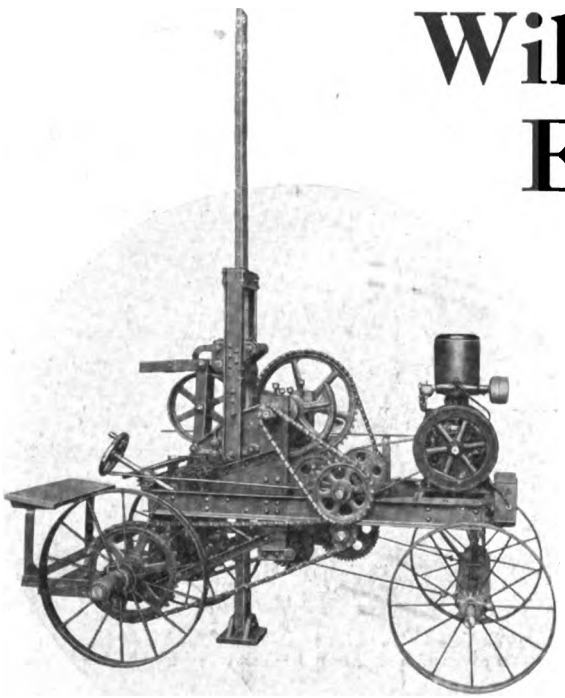

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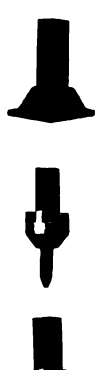

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VOL. XLVIII. JANUARY, 1915. NO. 1.

The circumstances under which the great majority of appointments to positions in the municipal service have been made in this country have given rise to a theory very generally held that almost anybody could "fill a city job." A large percentage of our people are firmly convinced, for some reason which is not easily explained, that municipal service is different from private service and that a certain amount of common sense and a willingness to work are all the requisites that are needed to fill such a position efficiently. We have worked during this administration and in this department under an assumption that these by no means constitute all the requirements. We believe that municipal service has everything to gain and nothing to lose by accentuating the points in which it is like the service in private institutions, and by minimizing the importance of those things in which it differs from private undertakings.—MORRIS LLEWELLYN COOKE, Director of Public Works, Philadelphia, Pa.

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THE CLEANING OF WATER MAINS

By J. F. Springer, New York City.

Cleaning of water mains is a difficult operation which was long considered too expensive for application. The reduction in capacity of mains at the same time with an increase in demand, has brought water works plants to the point of laying additional mains on the one hand or of cleaning the existing mains on the other. Methods of cleaning have developed slowly and have been reported from time to time for several years in MUNICIPAL ENGINEERING. *They have reduced the expense with the increase in efficiency. This article shows the principal methods now in use and the difficulties and expense to be met in cleaning systems of pipes not originally designed and constructed with facilities for subsequent cleaning.*

THERE are two distinct methods of cleaning the interior of a water main. One of these proceeds by dragging the cleaning device thru the pipe by means of a steel cable. The other operates by means of a cleaning machine which is carried thru the main by the force of the water. The cable system is used with very small pipe, from 3 to 6 inches diameter. For moderate sizes of pipe, from 6 to 10 inches, either system is applicable, while for still larger sizes the water-driven device is employed. These are general statements; particular conditions may impose some variation. In fact, in cases where the pipe is large and conditions in general indicate the water-propelled device, it will still be necessary to employ the cable system in the immediate vicinity of the reservoir where the pressure is either nothing at all or too low to furnish sufficient driving force.

The pipe system is laid off in sections which may vary from 50 feet in length to half a mile. Particular attention will be directed to making the sectional divisions at abrupt turns, the object being to avoid including them in the inaccessible parts of the pipe. An excavation will be made at each end of a section and portions of the main exposed. The length of pipe exposed at either excavation will vary from 2 to 6 feet or more, according to circumstances. The cleaning will be done in the direction of the flow of the water. The water will be turned off, but not until a length of pipe at each excavation has been diamond-pointed to a point within perhaps ⅛ inch of the thickness of the cast iron. These lengths will be entirely cut out after the shutting off of the water. Ditch pumps at the two excavations will take care of the dead water coming from the pipe. At the far end, looking in the direction of flow, a bend and straight length will be yarned in, the object being to provide a discharge end for the section of main that is now to be cleaned. The riser pipe will project obliquely above the surface. Up to this point, the general method of procedure is the same whether the cable system of cleaning is employed or that which uses the water-propelled machine.

Assuming that we are proposing to use the cable, we must now go ahead and get it thru the section of pipe. A winch with perhaps half a mile of steel rope is set up at each end of the section. At the near end the rope will be small, say 3/16 inch in diameter; at the far end, larger, say ⅜ inch in diameter. At the near excavation, either a special hatch box will be put in

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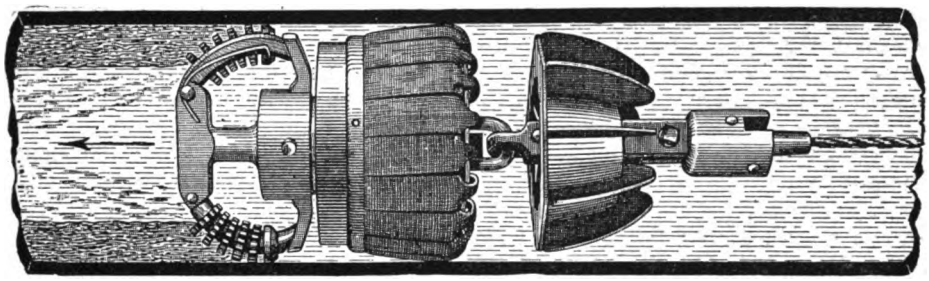

TURBINE machine for cleaning water mains. The water pressure from the left forces the machine thru the pipe. The revolving cutters in front scrape off the encrustations on the pipe, and water, let thru adjustable openings in the piston, revolves the cutters and forces the debris forward. The cord at the left serves to locate the machine if it is stopped for any reason.

place of the short length of pipe removed, or else a piece of ordinary pipe together with a sleeve will be arranged. A special device is put into the hatch box or arrangement of pipe. This is known as the carrier. Its function is to transport the end of the small rope thru the section of main. The rope is passed thru a stuffing box or perhaps thru a simple hole into the pipe and there secured to the carrier. When these arrangements have been made and the connections are found to be sufficiently tight, the water is turned on. The carrier is so designed that the flow carries it along thru the main and out at the far end. The carrier is now detached and the two ropes are secured together. The winch at the near end is operated and the small rope pulls the big one thru from the far end to the near end.

When the ⅛-inch cable is in place, the cleaning device is put into the hatch box, or the temporary pipe, with the cable attached. The hatch box or pipe is made up and the water turned on, but not at full pressure. The winch at the far end is started and the cleaning begins. Sometimes the carrier will stick. Its location may be determined by noting the amount of small rope withdrawn. An excavation will be made at this point and the difficulty dealt with.

The design of the carrier is quite interesting. In the patented device used there is first of all a cup or bell-shaped piece which fits into the main snugly, with its concave side opposed to the flow of the water. On the convex side the bell, made of rubber or other flexible material, is attached to a short cylindrical piece, which may be of wood. Stays of metal are attached to this piece and extend back to the bell, to which they are secured and supply it with resistance against a folding-forward movement. It will be understood that these stays are aranged at intervals in the circuit. Thru the piece of wood a wire passes, the rear end of which has an eye for the attachment of the steel rope. At the forward end of the device a cage in the form of a double pyramid is arranged. This contains within it a spherical shell of metal. This shell acts as a float, supporting itself and the cage. This part of the device acts as a guide. Because of its tendency to keep to the top of the pipe, it facilitates passage over lumps of lead lying on the bottom and past downgoing branches of the pipe. This apparatus has been in practical service, where it has demonstrated its capabilities.

If the pressure of the water is considerable, the use of the cable may be dispensed with and the water relied on to energize the cleaning device. Suitable pressures and other favorable conditions are usually found in connection with the larger sizes of water mains, say from 6 inches diameter up. In one device, propulsion is secured by means of a pair of pistons arranged with cleaning devices ahead and to the rear. The pistons have adjustable passageways thru them. These permit the passage of a restricted amount of water on ahead. This is a very necessary part of the ar-

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rangement, as otherwise the heavier cleaning would have to be done in the dry. The forward cleaners consist of a series of spiders carrying suitable knives or scrapers. These knives are set at right angles to the direction of the movement. To the rear of the pistons, two or three spiders are arranged with knives set at an angle to the axis of the pipe. By means of a kind of jointed or flexible shaft, the entire apparatus of cleaners and pistons is secured together, the whole having the appearance of a gigantic insect.

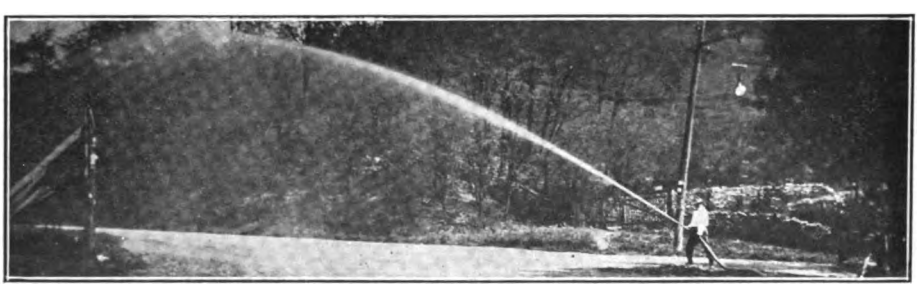
The cleaning is done by putting this affair, right end foremost, in the hatch box or the pipe arrangement at the near excavation and closing it up. When the water is turned on, the impulse against the pistons carries the device along. The knives cut and scrape, and are kept at their work by means of suitable springs or the like. The moderate amount of water passing thru the machine operates to carry off the debris from the walls of the main. In fact, an arrangement of blades diverts some or all of this water from the center outwards and thus puts it where it is mostly needed.

The adjustment of the orifices thru the pistons calls for practical experience. Once the machine starts, it cannot be recalled for better adjustment. Enough water must go thru to facilitate the cutting and to carry off the debris; enough must be left behind to drive the machine forward.

While the machine can not be recalled, still it may usually be located. There are three methods of doing this. First, the machine makes some noise. This is often sufficient to enable the ear to follow its forward movement. Second, the fire department hydrants will furnish by the character of the flow from them a means of approximating the position of the cleaning machine. Third, a small rope may be attached to the rear of the machine before starting it off. The length of this drawn in will serve to give the distance of the machine from the near excavation.

Another type of water-driven cleaner is sometimes used. This machine is a very effective piece of apparatus, being able to handle work that the other machine either can not do or can not do to advantage. This cleaner consists in part of a water driven turbine. The pressure of the water acting on a piston effects the drive. A certain amount of water, however, is permitted to pass thru the turbine, setting up a rotary movement of part of the apparatus. This circular motion is utilized to effect a scrap-

TWO PHOTOGRAPHS, *one taken before cleaning and one after, show the improvement in discharge from a hydrant on the water distribution system at Madison, Ind., by cleaning the mains.*



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ing and cutting action across the direction of movement of the whole device. This rotary effect has proven very successful. Thus, at Salt Lake City, there was certain piping 16 inches in internal diameter which had an incrustation 2 inches thick. So difficult was the cleaning operation that the ordinary machine method proved scarcely adequate. In order to get results, the ordinary apparatus had to be taken thru repeatedly. The turbine machine was found quite competent for the work.

¶ PROVISION *for subsequent cleaning should be made during construction or in connection with the first cleaning of an existing system.*

The cleaning of water mains by the foregoing methods has proved a very practical business. It is not a theory of what might be accomplished; but something which has been demonstrated by 500 or 600 miles of actual cleaning done under some form of contract. In the Boro of Brooklyn, New York City, alone, the amount of cleaning up to date totals in the neighborhood of 75 or 80 miles. In some communities the procedure has been carried out more than once.

In fact, the special hatch box used for the opening up of the main itself is a device which is used in contemplation of repetition work. The hatch box is put in as a permanent part of the line. This installation has been made in some cases a part of the cleaning operation. But in some others, the hatch boxes are introduced into the line at the time of original construction. This is notably the case at Troy, N. Y., where the 30-inch line is being equipped at intervals with this device. This special fitting consists essentially of a short length of pipe with the regulation nozzle and bell ends. There is, however, a portion of the body cut away. Here is provided a cover with bell ends. The cover is bolted in place and so may be accurately and quickly put in position. When the cover is in place, the whole forms simply a section in the pipe line. The internal diameter is, however, greater thruout most of its length than that of the pipe line. At the forward end the connecting taper is gradual. This taper is thus suited to the progressive compression of the cleaning device as it starts on its journey, and so facilitates the start off. At the rear end, there is, of course, a connecting taper, but it is fairly abrupt. The device is a patented one.

¶ COST OF CLEANING *in specific instances is given, with statement of conditions, that some idea may be gained of the probable cost in ordinary cases.*

The cost of cleaning varies with the local conditions. The principal concern engaged in the work supplies the foreman labor and the equipment. Perhaps as good an idea of the expense as can easily be acquired will be obtained by considering the case of Hartford, Conn., where a considerable amount of cleaning was recently carried out. This city is supplied by three mains, all cast iron. The diameters are 20 and 30 inches. All begin at a single reservoir several miles from the city hall. The ages at the time of cleaning varied from 16 to 37 years. The consumption of the city was steadily advancing, and it was realized that a new main would soon become inevitable. However, it was also seen that if a thoro cleaning of 9 miles of main would result in restoring the efficiency of the mains to a point which would make it possible to defer the installation of a new 36-inch pipe line for five years, not only money for the cleaning would be secured from the delay, but also money in excess. The minimum cost of the new line, 6¼ miles long, has been put at $270,000. In five years, interest compounded at 5 per cent. would amount to $74,500. An advance estimate of the cost of cleaning 3 miles of 30-inch pipe and 6 miles of 20-inch pipe put the cost at $15,300. Consequently, it was clearly to the advantage of the city to do the cleaning. But Hartford desired to be sure, before going ahead. So inquiries were made, amongst others, of Cincinnati, Rochester, Newton, Mass., St. Louis,

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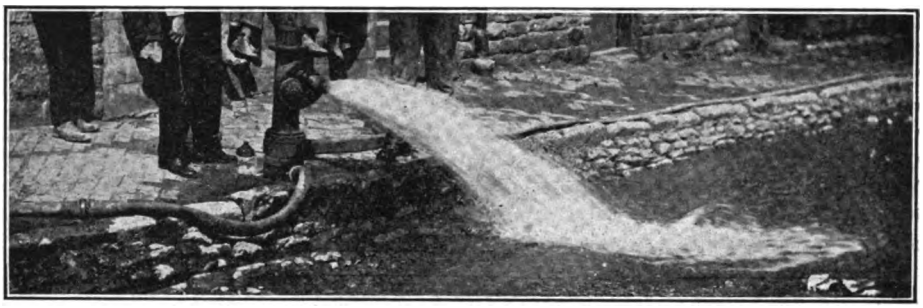

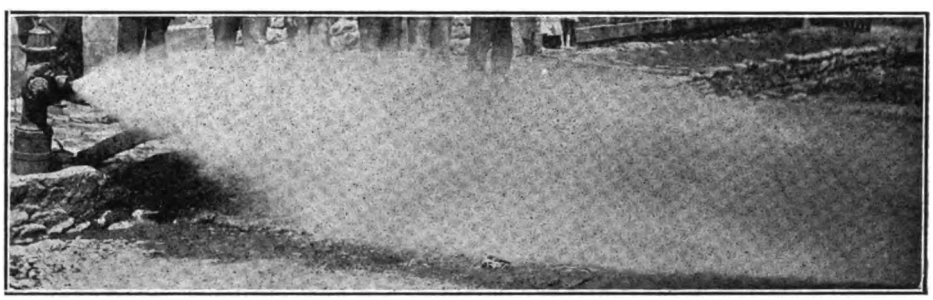

TWO PHOTOGRAPHS *show the increase in force of the flow from an open hydrant on a 4-inch main in Newport, Ky., made by cleaning the main.*

Brooklyn, Atlanta and the American Water Works & Guarantee Co. of Pittsburgh. All had had experience with large pipe. Apparently the replies were, on the whole, satisfactory, as a contract was entered into for a trial cleaning of 3 miles of 20-inch pipe. Ultimately, 6¼ miles of pipe were cleaned. The actual contract price for the first 3 miles, as stated by the Chief Engineer of the Board of Water Commissioners, was 28 cents per linear foot, the contractor furnishing all labor concerned in the cleaning operations. There was to be a reduction if a greater length was cleaned. Ordinarily, at Hartford, there was a force composed as follows: 1 superintendent, 1 foreman, 1 calker, 14 ordinary laborers and a 2-horse team. The minimum pressure available was something in excess of 10 or 12 pounds per square inch. These pressures are ordinarily sufficient to drive the spider type of machine, the one employed for the work. There were three spiders in the forward section. These had cutters with saw teeth. Then came two spiders with smooth scrapers. Following these were two pistons. Behind them, bringing up the rear, were two rings of scrapers set askew. These scrapers were, in the one case, set in agreement with a right hand thread; and, in the other, with a left hand thread. In the whole machine, there were thus 7 separate circlets of scraping tools. The main cutting is done ahead of the pistons.

The cleaning at Hartford was suspended after cleaning 6¼ miles because of the scarcity of water in the reservoirs. Five miles belonged to the 37-year-old 20-inch pipe and 1¼ miles to the other 20-inch main, which was 25 years old or more. Careful tests of capacity were made in both cases both before and after cleaning. After cleaning, the capacity in both cases was found to approximate that for new pipe. Further, the increase in capacity in the older line was found to be 69 per cent. In the case of the younger main, the increase was 50 per cent.

The consumption of water in the cleaning process was experimentally ascertained to be about 3 times the quiescent capacity of the portion of pipe cleaned. Altogether, it is estimated that the 6¼

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miles of 20-inch main required 1,655,000 gallons.

The material which clogs a pipe may be iron oxide or it may be a calcareous deposit, or something still different. The thick deposit mentioned as occurring at Salt Lake City seems to have been a carbonate of lime. In color, the material may be almost white; then it will be a red or a gray or a still darker hue. It is composed at times almost entirely of ingredients furnished by the water alone. At other times, the pipe itself will contribute a considerable percentage. Sometimes the obstruction in a pipe will consist largely of sediment made up of mud, rock particles and dead organisms. Such obstruction is usually fairly soft and presents but little difficulty in cleaning.

It will readily be granted that where the effective cross-section is cut down, so also will the capacity of the pipe. However, the flow of water is nearly always impeded to a considerable extent by small incrustations which scarcely affect the cross-section. Incrustations in the form of small and separated nodules will seriously affect the velocity. They may be not over 1-16 or ⅛ of an inch in height. Such nodular incrustations were sufficient in the case of a 48-inch main to reduce its capacity 30 per cent. This loss must be attributed almost entirely to friction; the nodules must have reduced the cross-section only by an inappreciable degree. That such excessive reduction of capacity may result from simple roughness of surface is confirmed by experience with coated pipes. It is said that a variation of as much as 25 per cent. may arise from the greater or less degree of smoothness of the coat put on. It is clear then that we have in the mere roughing of the surface a serious cause of reduced efficiency.

It will be understood then that a cleaning operation may be indicated as the proper step even where the cross-section remains approximately the same. The way to get convincing testimony is to compare a test of efficiency when pipes were new with another test made at a time when substantial loss of efficiency is suspected. Or, comparison of present flow with the flow that should be attained is another method of testing the matter. This is not as satisfactory a procedure as the comparison of two actual performances; inasmuch as the calculation of what should be turns on formulae, in using which it is difficult to take into account the special local conditions. In comparing two actual performances, nearly all the important factors except the incrusted interior are precisely the same for both. This results in reliable information.

PUBLIC BATH AND GYMNASIUM

The most extensive public bath and gymnasium yet designed for New York is located opposite Chelsea park. William Emerson is architect of this handsome and convenient building, photograph of the drawing for the front of which is shown herewith. It provides public laundry in the basement, boilers and machinery for heating, lighting and ventilating the building and supplying water for shower baths and pool, swimming baths and gallery in first and second floors with shower and tub baths on the remainder of both floors; gymnasium in the third and fourth floors with running track around at the level of the fourth floor, and outdoor play space over the entrance lobbies and stairways, on the level of the fourth floor and over the rest of the building on the fifth floor. It cost about $165,000.

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Street Lighting Fixtures

The modern high-candle-power incandescent electric lamps have made necessary entirely new designs for fixtures for street-lighting service. Some of these new forms are illustrated and described in this article, which will give data for comparison with other modern systems by those contemplating improvements in their present street lighting.

THE introduction of high candle-power Mazda lamps and the new conditions under which they operate required the design of an entire new line of fixtures to accommodate them properly. The several specific reasons that have induced the development of these distinctly different types of fixtures are the following:

1. The intense brilliancy of the lamp requires that the light source be screened in order to obviate all of the disadvantages from glare.

2. The lamp in operation is designed to reach a very high temperature, and it is essential that the fixture be so ventilated that it is maintained at a temperature which will do it no injury.

3. The lamp must be protected from moisture and atmospheric changes.

4. The shape and size of the bulb being different from that of previous standards of the vacuum lamp, it was necessary to make a fixture that would bring the light center to the correct location.

5. Due to the fact that high-current series lamps operate at a very much greater efficiency, it is very desirable to provide an individual compensator in each lamp that will increase the current in the lamp from 6.6 or 7.5 amp. to 15 or 20 amp., as the 400 c-p. lamps operate at 15 amp. and the 600 and 1,000 c-p. lamps at 20 amp.

To provide for these contingencies, complete lines of street lighting fixtures have been designed that fulfill every requirement. In general, these fixtures may be divided into three different classes, namely, bracket type, pendant type and ornamental type.

The bracket and center-span suspension fixtures, which are almost universally known, have been re-designed to accommodate the following reflecting equipment: Radial wave reflector, concentric reflector or concentric reflector with prismatic refractor.

The pendant units have been designed in two different classes, known as Form 1 and Form 2. The Form 1 unit has been designed to resemble the arc lamp in general contour and appearance. It has a very substantial construction thruout. These units can be furnished with an opal diffusing globe, an opal diffusing globe and concentric reflector, a prismatic refractor and clear globe, or a prismatic refractor.

The Form 2 pendant units are unique in appearance and cost less than the Form 1. They are arranged to use a diffusing globe, concentric reflector and diffusing globe, radial wave reflector, or a concentric reflector and prismatic refractor. Both the Form 1 and Form 2 units are arranged to take a compensator, which is mounted under the dome and inside of the casing.

The ornamental Novalux Unit has been designed to fill the demand for a highly ornamental unit where "White Way" lighting is desired; and two different styles of ornamental units, known as the Forms 4 and 5, have been standardized.

NOVALUX *ornamental street lighting unit with upright lamp.*

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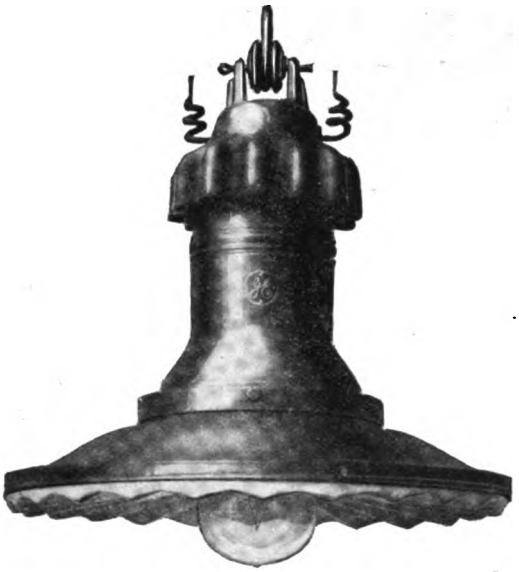
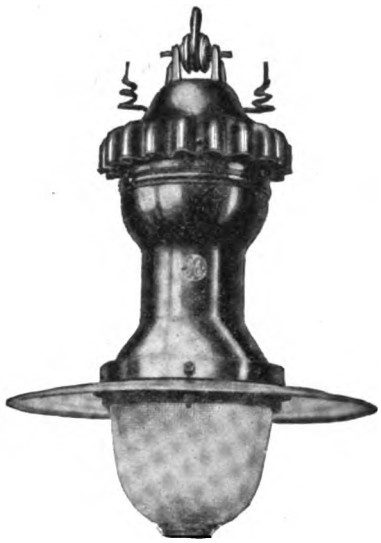


PENDANT *Novalux street lamp resembling an arc lamp in appearance.*



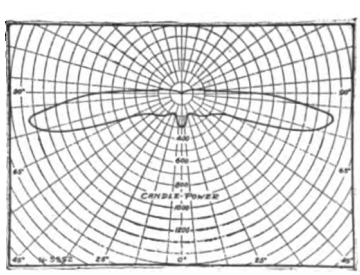
DISTINCTIVE *original design for Novalux street lamp, which is also cheaper.*

Light distribution from a bare incandescent lamp is not suitable for street illumination. By using the various forms of fixtures equipped with reflectors and outer globes, this distribution, altho at a decrease in specific consumption, is improved to such an extent that the illumination is more economical. It was not, however, until the introduction of the prismatic refractor that the distribution from incandescent units could be so directed as to produce a decided maximum at an angle approximately 10 degrees below the horizontal. With such a distribution, it is now possible to increase the spacing of these lighting units without destroying the even illuminating effect that heretofore could only be accomplished with incandescent lamps by using a number of comparatively low candlepower units.

The accompanying distribution curve gives a graphic idea of the improvement given by the prismatic refractor. The refractor used in these lamps consists of two sections one fitting inside the other. The inner section is girdled by a succession of horizontal prisms, which converge the light rays into the most useful zone; while the outer globe is lined with a series of vertical prisms, which serve to diffuse the light. The inner surface of the interior section and the outer surface of the exterior section are smooth; therefore, both sections when placed together and the top cemented present smooth outside surfaces, which facilitate cleaning, as they do not readily gather dirt and dust.

All fixtures described are suitable for all standard commercial circuits, both series and multiple.

CHARACTERISTIC DISTRIBUTION CURVE *of 600-c.p. Mazda series lamp unit with concentric reflector and prismatic refractor.*



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BRICK ROADS AND STREETS

By John Laylin, Division Engineer,
Ohio State Highway Department, Columbus, Ohio.

The author of this paper gives his experience in municipal and state highway improvement work in which brick has been used as the paving material, and the methods in use by the Ohio State Highway Department, at the request of the management of the Road Congress held in Chicago with the American Road Builders' Association. It is therefore an official statement of the methods and results in a state which has used more brick in both city streets and country roads than any other.

THIS paper will treat this subject largely from the writer's experience in municipal and state highway improvement work.

Ohio statutes provide for state aid in road building on a system of inter-county highways, so-called, lying wholly without the limits of municipalities, comprising a network of roads aggregating about 9,500 miles, and connecting all county seats and towns of any considerable size within the state.

The law is very flexible in regard to the distribution of costs of improvements and was designed to meet all possible conditions, but in a general way it may be stated as 50 per cent. to the state, 25 per cent. to the county, 15 per cent. to the township and 10 per cent. to abutting property. County commissioners designate the particular section of the particular inter-county highway that shall be improved in any year and guarantee the payment of costs to be levied against the county, township and property owners, and further determine the particular type of improvement to be made.

Inasmuch as the county commissioners are a party to every contract made and entered into, it may be readily understood that the highway commissioner does not select the particular type of pavement to be constructed, even if inclined to do so. Types of pavements are generally selected, however, that best suit traffic conditions and utilize suitable materials near at hand.

The highway commissioner has ever tried to treat all material and supply men with the utmost fairness, and his splendid success in the management of the department and the construction of a great highway system is largely due to the hearty co-operation of all classes of material and supply men.

After a type of pavement has been selected for a section of road to be improved, then the commissioner does insist that the construction of the work shall be of the best for that particular kind of pavement.

The essentials of a good road or street are good alinement, easy grades and perfect drainage.

Resident engineers working under the directions of department division engineers make the field surveys, plat the alinement, profiles and cross-sections, and work out all questions of new locations, grades, cross-sections, sewers and drains, bridges and culverts, and plans are made to show type and dimensions of foundation, thickness of sand cushion, kind and dimensions of curbing, kind and thickness of expansion joints, all details of drainage, bridges and culverts, and

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everything not fully set forth in the general specifications of materials and workmanship.

In passing, it might be said that efforts are always made to secure a clear sight view of at least 300 feet, a maximum gradient of 8¾ per cent. and a drainage system that will maintain a water level well below the base of foundation of pavement.

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¶ THE OHIO STATE *Highway Department specifications have been carefully prepared and produce excellent pavements.*

The 1914 specifications for brick pavement improvements provide as follows:

In the preparation of the sub-grade, all muck, quicksand, soft clay and spongy materials that will not consolidate under the steam roller shall be removed, that back filling of all excavations shall be rammed in courses of not more than 6 inches of loosely filled earth, that embankments shall be built up from the bottom in successive, even layers not exceeding 12 inches in thickness, that each of these layers shall be rolled until thoroly compacted, that when the slope exceeds 2 to 1, such slope shall be furrowed before any material is placed thereon, and that areas on which embankments less than 1 foot in depth are to be placed shall be broken up by plowing or other means.

After the surface of the sub-grade has been properly shaped, the road-bed shall be thoroly rolled and compacted so that it does not wave or spring under the roller. Rolling shall be done with a self-propelled roller weighing not less than 6 tons.

Foundation for pavement may be of either portland cement concrete, old pavement, compacted broken sandstone, limestone, slag, gravel or vitrified clay.

Great care is to be used in selecting aggregates for concrete, all materials being submitted to tests to insure quality meeting requirements as specified in Bulletin No. 25, General Specifications for Materials.

Aggregates are so proportioned as will produce concrete substantially composed of 1 part cement, 2½ parts fine and 5 parts coarse aggregates, in which the mortar shall not be less than 110 per cent. of the volume of the voids in the coarse aggregates.

Coarse aggregates may consist of crushed boulders, crushed limestone, slag or gravel that will pass a screen having openings 1½ inches in diameter and be retained upon a screen having openings ¼ inch in diameter.

A cubic yard of concrete in place shall not contain less than five sacks of cement.

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¶ THE MIXING *and placing of materials and treatment of completed pavement before letting traffic on it are most important details in securing a good pavement.*

Concrete shall be mixed in a batch mixer, so-called, the drum of which shall not make less than 15 revolutions at a speed of between 15 and 20 revolutions per minute.

Materials shall be mixed sufficently wet to produce a concrete that will require no tamping. Sub-grade must be moist before concrete is placed thereon.

The surface of concrete shall be shaped by the use of a suitable template cut to conform to the crown of pavement, and shall be floated in such a manner as to thoroly compact the concrete and produce a surface the exact crown specified. The finished surface of the concrete shall conform so nearly to that indicated on the plans that it will nowhere vary more than one-half inch from the previously described templet or a 10-foot straightedge applied to the surface of the concrete and parallel with the center line of the pavement.

Care shall be taken to protect concrete from rapid drying out and freezing, and traffic is prohibited for ten days from time of laying.

A thoroly consolidated old macadam or gravel road, if of sufficient depth, may be considered satisfactory pavement foundation. The old road shall be thoroly cleaned, and, if irregular, shall be scarified, graded to the proper elevation

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and all depressions filled with the same material of which the course consists. All foundation material placed must be thoroly filled, waterbound and compacted.

Rolled foundation shall consist of either gravel, broken sandstone, limestone, slag or vitrified clay. Sandstone fragments must not exceed 6 inches in greatest dimension, and all other materials must pass a screen having 4-inch circular openings and be reasonably well graded from 4 inches down to the smallest size found in the product.

Gravel shall not contain more than 15 per cent. of clay or loam.

Rolled foundation shall be constructed as a one-course waterbound macadam pavement and brought to the proper crown and grade within the limits specified for concrete foundation.

Curbing shall be either sandstone or concrete of dimensions indicated on plans and quality as specified in said Bulletin No. 25.

Sand cushion shall not contain more than 8 per cent. by weight of clay or loam. Sand shall be spread over foundation, shaped with templet, rolled till compact, and made ready to receive the paving blocks.

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¶ LAYING OF BLOCKS *and pouring of cement grout filler must be carefully and properly done or the result will be disappointing.*

Paving blocks shall be laid in an upright position upon the sand cushion, in straight courses across the road, and shall be laid so that the longitudinal joints are broken approximately at the center of each block and the long dimension of the block is perpendicular to the center line of the road on the tangents and practically parallel with the radius of curves having a radius not greater than 150 feet.

All blocks to be laid with the lugs in the same direction and set as closely together as possible. In all cases the end joints shall be made close and tight, the joints to be at right angles to top and sides. The cutting and trimming of blocks shall be done by experienced men and proper care shall be taken not to fracture or injure the part to be used.

After a sufficient number of blocks shall have been laid the pavement shall be thoroly dampened by sprinkling, and all soft, porous or unacceptable bricks will be marked by the inspector and shall be removed by the contractor. When any section shall have contained more than 10 per cent. of rejections, the blocks of the entire section shall be taken up and the cushion readjusted. As soon as possible after the blocks in the pavement are inspected, rejections removed and replaced with acceptable blocks, the surface shall be swept clean and then rolled with a self-propelled roller weighing not less than 6 tons. When rolling and ramming are completed, the surface of pavement shall conform so closely to that indicated on the plans that it will nowhere depart more than ⅜ inch from a properly formed templet or a 10-foot straight edge applied to its surface.

Soon after the pavement has been compacted and surfaced, the joints between the blocks and the curb shall be filled with a grout filler composed of one part portland cement and one part sand. Detailed specifications set forth manner of applying grout.

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¶ SPECIFICATIONS *for paving brick are standard and have demonstrated the value of years of careful work in devising and improving them.*

Paving brick specifications provide:

That the brick shall be standard wire-cut-lug or repressed paving block of standard size. The standard size of brick shall be 3½ inches in width, 4 inches in depth and 8½ inches in length. The brick shall not vary from these dimensions more than ⅛ inch in width and depth and not more than ½ inch in length, and the brick of the same shipment shall not vary more than ⅛ inch in width or depth. They must be thoroly vitrified and annealed, regular in size and shape and uniformly burned. When broken, they shall show a dense, stone-like body, free from lime, air-pockets,

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cracks and marked laminations. No surface of any brick shall have kiln marks more than 3/16 inch in depth or cracks more than ⅜ inch in depth and the wearing surface of the brick shall not have kiln marks more than 1/16 inch in depth and shall be free from cracks. The brick shall have not less than four nor more than six lugs, all on one side of the brick, such that when the brick are properly laid in place in the pavement, the joints between the brick will be not less than ⅛ nor more than ¼ inch in width. The name or trade mark of the manufacturer, if shown on such brick, must be by a recessed design or by recessed letters and not by a raised design or raised letters.

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¶ METHODS *of selecting brick for abrasion test and methods of making the test are those proposed to the American Society for Testing Materials, which are still under discussion and observation as to their sufficiency.*

If the edges of the brick are rounded, the radius shall not exceed ⅛ inch. The brick must not be chipped in such a manner that neither wearing surface remains intact or that the lower or bearing surface is reduced in area by more than .1, but such brick, if otherwise satisfactory, may be used in obtaining the necessary half brick for breaking courses and the necessary pieces of brick for closures provided that the wearing surfaces of the part of brick used shall be intact. The brick shall not be glazed. To determine whether the material of the brick as a whole possesses to a sufficient degree strength, toughness and hardness, samples of the brick shall be submitted to the rattler test. The test shall be made in accordance with the method and in a rattler as described in the recommendations by the sub-committee on paving brick to the American Society for Testing Materials. Five samples of each kiln or shipment may be selected; one sample from what appears to be the softest brick and one sample from what appears to be the hardest brick, neither of which shall lose of their weight more than 24 per cent.; and three samples representing an average of the kiln or shipment, which shall lose of their weight not more than 22 per cent.

The quality of the brick shall be of such uniformity that the range between the highest and lowest loss by abrasion shall not exceed 8 per cent. If the kiln or shipment of brick should fail to meet the above requirements, and it is fair to assume that it would meet them if not more than 10 per cent. are culled, then the contractor may, at his option, regrade the brick. When the regrading is complete, the kiln or shipment then shall be resampled and retested, as under the original conditions, and if it fails to meet any of the above requirements, it shall be finally and definitely rejected. Sampling may be done at the factory prior to shipment and brick accepted as the result of such sampling will not be rejected as a whole, but will be subject to such culling as may be necessary to meet all of the requirements except that of the rattler test.

The Ohio State Highway Commissioner let contracts for brick roads in 1912, 1913 and 1914, mileage as shown in the following table:

	1912.	1913.	1914.
Mileage brick roads contracted.....	33.47	27.71	164.0
Per cent. brick road of total mileage of all roads	20.7	17.7	32.5
Contract price for brick roads.....	$507,899.19	$486,925.87	$3,415,584.45
Per cent of total contract price of all hard surfaced roads.....	36.4	35.3	46.3
Average contract price per mile for brick roads	$15,680.00	$17,572.00	$20,827.00
Average contract price for brick roads per foot in width per mile.....	$1,150.00	$1,379.00	1,364.00

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The contract price for brick roads included grading, draining, curbing and paving for the years 1912 and 1913, but also included bridges and culverts for the year 1914.

In the preparation of our plans it is our endeavor to embody the use and requirement of the best possible foundation, and the best possible drainage consistent with the economy of the road.

Following this rule, a concrete foundation for brick pavements is generally provided, and as the greatest assurance against longitudinal cracking in the wearing surface, the advantage of a dry subbase is considered essential. It is the general belief that brick pavement cracks are caused more by frost action than high temperature stresses. In fact, a sufficient and proper drainage of the sub-grade of all roads, including the brick road, is regarded as of the utmost importance. Frost has little effect where moisture is almost entirely absent; hence these provisions carefully observed are certain to reduce to a minimum all deleterious climatic effects.

There are a few examples of brick pavement construction that the writer especially desires to call to attention.

¶ SPECIAL DESIGNS *for brick pavements are cited and success in use and beauty of appearance are indicated.*

The Cleveland-Buffalo I. C. H. No. 2, in Lake County, is a 2½-mile improvement with brick surface 18 feet in width, curbed on either side with a 24-inch concrete gutter having a 2½-inch concave surface. These gutters collect the water that falls on pavement and lawns and conduct it to catch basins connected with a system of underground drains. The pavement is laid on a 4½-inch concrete foundation. The lawns slope back from the gutters and the parklike effect is very pleasing.

Many of the brick pavements in northern Ohio on streets and roads having a sandy or gravelly soil are laid on natural bed foundations, and where traffic is light or medium such streets are giving first-class service. Many such streets have been in use 20 years and more, and they give every evidence of being good construction.

Two streets in Norwalk, Ohio, have been laid on natural bed foundations and edged with vitrified curbs. These curbs were made on a regular paving brick machine with three out of four of the cutting wires removed, thus making a block that when burned was 4 by 8½ by 15½ inches. These blocks were set with the 8½-inch dimension vertical and set in gravel or crushed limestone.

The pavement when grouted with a 1-to-2 cement mortar practically became monolithic. This work has been in place less than two years, but it looks like good, cheap pavement construction. The writer has watched for a number of years two streets in a small village that were curbed with ordinary paving block stood on end and thoroly grouted. The earth next to such blocks has worn away in places and the edges of the bricks have become rounded, but they are still doing business and holding pavement intact.

A number of Ohio roads have been designed and constructed with concrete foundation and curb constructed monolithic, and such construction is to be recommended.

¶ ROADS ABOUT CLEVELAND, *constructed without State aid, are briefly described and the improvements in design and construction are noted.*

Cuyahoga County, Ohio, is noted for its brick country roads, there being over 350 miles outside of the City of Cleveland.

These roads have generally been constructed 14 feet in width, located on side of roadway, the balance of roadway being graded to width of 7 feet or more and used as an earth drive.

The earlier roads built were constructed with rolled foundations and not very much attention was paid to matter of drainage, but brick roads as now constructed are well drained and provided with concrete foundations. Concrete and sandstone curbing is employed, and in

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all cases the pavement slopes so the surface drainage flows away from the earth track. Raised curb is often used on the outside, and on hills raised curbs are used on both sides of pavement, drainage being provided by catch basins and underground drains.

On hills, hillside block and Medina block are used.

Traffic is very heavy in and about Cuyahoga County, and the brick roads seem to have solved the road problem.

In conclusion, it may be said:

That brick roads and streets should always have a solid sub-grade, perfectly drained.

That a concrete foundation should be provided wherever traffic conditions are heavy, and that the surface of concrete foundation should be made true and smooth and exactly parallel with the crown of street.

That the sand cushion should be thoroly compact and from 1½ to 2 inches in thickness.

That a cement grout filler is the best filler.

That a brick road is a dependable road.

The paramount interest in brick roads that more greatly concerns the tax-paying public is the same that is involved in the expenditure for any road, no matter what the type, and that is the efficient building of the road itself, the compliance with the plans and specifications. The proper construction of a brick road is no more difficult than the construction of any kind of road, but every requirement of the plans and specifications should be carried out. Plans, specifications and contract presuppose that each and every requirement therein is a part and parcel of a necessary adjunct to the value of the road intended to be built. A complete co-operation of the combined influences of public sentiment, official authority and the obligation of the contractor are necessary to reach the ideal in road building. Without the combined forces of all, the most conscientious official, the most diligent contractor or an anxious public acting singly and alone can not attain the best results.

Transcontinental Automobile Routes

Late reports indicate that the road improvements on the principal cross-country lines during 1914 have been underestimated rather than overestimated. This is particularly the case on the western end of the "Northwest Trail," between Montana and Seattle, especially since the former severe grade of Snoqualmie Pass has been reduced to a maximum of 5 per cent.

Hundreds of miles of the Lincoln Highway have been improved and marked. In Ohio over three-fourths of the entire length of the route has been hard-surfaced with cement, brick or other material. In Indiana the bond issues passed by the local communities aggregate over three hundred and fifty thousand dollars. On September 16, Elkhart, Ind., opened a section of concrete Lincoln Highway 18 feet wide; work is now in progress on a 6-mile section near Fort Wayne; St. Joseph county, in which South Bend is located, has voted $175,000 for immediate improvement. Governor Dunne, of Illinois, personally began work on the Lincoln Highway in his state on April 16, by turning over the first spadeful of earth at Mooseheart, and on the 16th of June, this section was opened with appropriate ceremonies as a part of the Lincoln Highway. Five counties in Iowa have voted a total of $140,000 for Lincoln Highway improvement.

Both the "Trail to Sunset," and its principal alternate, the Santa Fe-Grand Canyon-Needles Highway, have not lagged behind the others, and, beginning next year, the tourist has two complete options between Albuquerque and southern California, both of which can be traveled with comfort and safety. The National Old Trails road has been marked from the Pacific coast to Kansas City and in sections farther east.

While, unfortunately, some parts of the "All-Southern Route" are yet in poor shape, that line as a whole has been greatly improved during 1914, and will not present very serious difficulties to tourists who decide to go leisurely across that way in 1915. The A. A. A. Touring Board has the latest information on all these lines, and is prepared to confer with tourists on the routes best suited for their particular purpose.

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CONCRETE CURB AND GUTTER

AS CONSTRUCTED IN DENVER, COLO.

By E. B. Van de Greyn, Consulting Engineer.

Some years ago the city of Denver, Col., introduced a method of constructing concrete curb and gutter without separate mortar facing and mortar top, which has been successful. The author of this article describes the process from his personal experience with its use in Denver and in other localities.

THE form of combined concrete curb and gutter generally constructed consists of a concrete body and a mortar coat on the exposed faces. The mortar face on the curb is secured by plastering the form board ahead of the concrete work, or it is secured by using a templet just behind the face board and after the concrete is in place and stiff enough to stand up the templet is removed and the space between the concrete and face board filled with mortar. In many instances in such work it is observed that the mortar facing checks badly and in some extreme cases the mortar falls from the body of the curb.

In the city of Denver for some time past the mortar facing and top has been dispensed with in combined concrete curb and gutter work, and the finish made directly on the concrete by proper spading and trowelling. This resulted in lessening the cost to the property owner an amount worth saving, and also resulted in work that does not show check marks. The appearance of the curb and gutter has been satisfactory enough so that there are no complaints from property owners on that score. There are, of course, the complaints that come when a contractor has a piece of work spoiled by bad workmanship or material or because of putting in concrete in freezing weather. Several hundred thousand linear feet of such solid curb and gutter have been constructed in Denver in recent years, the first of such work being started under Hon. John B. Hunter, then chief engineer of the city and county of Denver and now commissioner of public improvements. The fact that such a large amount of the curb and gutter has been constructed in the past and that more is being constructed is evidence that it has proven satisfactory to the property holders.

The proportion of the concrete used in such work should be such as to allow of an ample surplus of mortar over what is needed to fill voids in the gravel or broken stone. This excess is needed in getting a good finish on the exposed face of finished work. The proportions commonly used in Denver were 1:3:3. Recently a 1:2½:3½ mix has been adopted with good results. A finish can be secured with 1:2:4 mixture but it is not recommended because such a mixture requires more work to secure a finish and there is danger with careless workmen of not being able to get a good finish in spots. Assuming voids in stone at about 40 per cent., 1:3:3 mixture gives an excess of mortar over that required to fill voids of about 150 per cent.; in the 1:2½:3½ mixture the excess is about 80 per cent. The writer had contractors on several jobs try out various mixtures and finds those mentioned give excellent results.

The method of finishing the concrete

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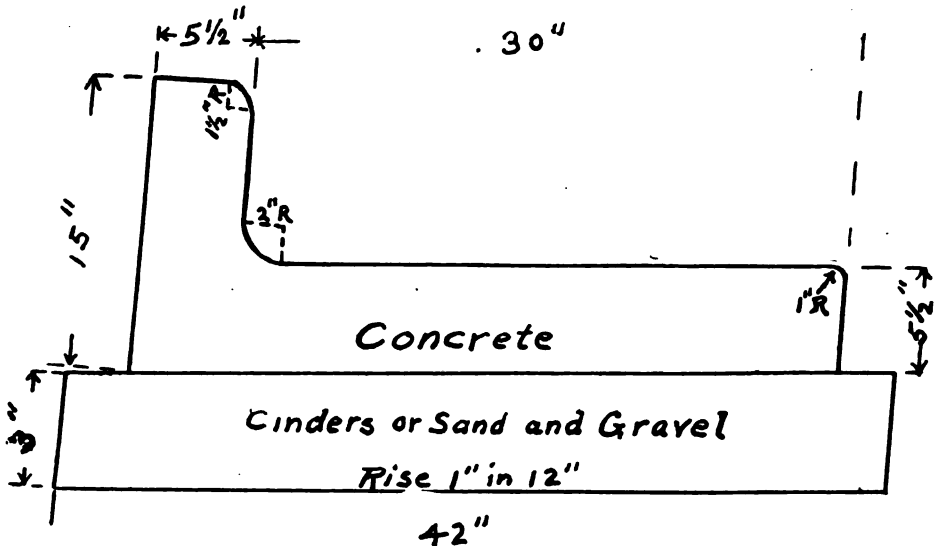

SECTION *of combined curb and thirty-inch gutter. An expansion joint three-sixteenths inch wide is located every six feet.*

is as follows: The concrete is mixed quite wet, i. e., to a mushy consistency, and is shoveled and tamped if needed. One man immediately strikes off the surface of gutter with a straight edge resting on the steel templets which cut the curb and gutter every six feet. This straight edge is worked back and forth forcing the stones down and leaving the mortar on top. Following this a second man works the top of the concrete with a wood float. If a smooth finish were desired in the gutter a steel float could be used. The working of concrete with trowels brings the mortar to the surface.

On the curb work the concrete is spaded thoroly along the face board and the top of curb is struck off with a straight edge in a manner similar to gutter. Following this after concrete has dried a little a man finishes top of curb with steel trowel and runs an edger over top corner of curb. As soon as concrete has set sufficiently to allow it the face board is removed from curb and the steel templets are pulled. Then the finishers run a steel edger along outside edge of gutter and on both sides of expansion joint in gutter. This gives a panel effect to each 6-foot section of gutter. Two steel trowels are used on the curb; one trowel is curved to fit top of curb and come down about half way on face of curb; the other trowel reaches halfway or more up the curb face and about 4 inches onto gutter. These trowels are bent to give the radii required at top corner of curb and juncture of curb and gutter. Occasionally a spot is found where the rock shows and this is doctored by trowelling in a little mortar. As soon as practicable after curb is finished the curb and gutter are covered and kept moist.

To illustrate the organization used on this work and what can be done the following is given for one day's work by one of the best equipped contractors. The writer was furnished the following data by The Gaffey and Keefe Construction Co. of Denver. The dimensions of curb and gutter are shown in sketch submitted herewith. Material costs were as follows:

Cement, delivered on work....$1.75 bbl.
Sand, at pit.....$0.33 cu. yd.
(One team hauled 8 cu. yds. in 8 hr. day.)
Gravel, at pit ..... .66 cu. yd.
(One team hauled 8 cu. yds. in 8 hr. day.)
Cinders, delivered, about.... .60 cu. yd.
(It might be noted here that the standard plans of the city call for cinder bed 6 inches deep, but 3 inches was used on this job.)

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Equipment used on job, not including wagons for hauling concrete material, was:

1 ¾-cubic yard cube mixer.
6 1-horse concrete carts each 2/3 cubic yard capacity.
2 water wagons.
1 wagon for moving forms.
Other small tools such as shovels, barrows, concrete pan, etc.

The organization and hours of labor were as follows:

2 foremen, 8 hours each.
1 timekeeper.
1 night watchman.
2 water boys, 8 hours each.
6 1-horse carts and boy driver, 8 hours each.
1 team and driver on wagon moving forms, 8 hours each.
2 teams and drivers on water wagons, one wagon used for wetting down cinders and other wagon for keeping finished curb wet, 8 hours each.
Form setters, 27 man hours.
Helpers, 52 man hours.
Cinder men, 67 man hours.
1 gutter tamper, tamping base under cinders, 8 hours.
2 tampers, tamping cinders and concrete, 8 hours each.
Men shoveling concrete from pan into curb and gutter, 40 man hours.
1 finisher, 8 hours.
Helpers to finisher, 40 man hours.
Men wheeling gravel and sand to mixer, 48 man hours.
Man and helper feeding cement to mixer, 16 man hours.
1 engineer, 8 hours.
Labor on ditch for curb, 192 man hours.

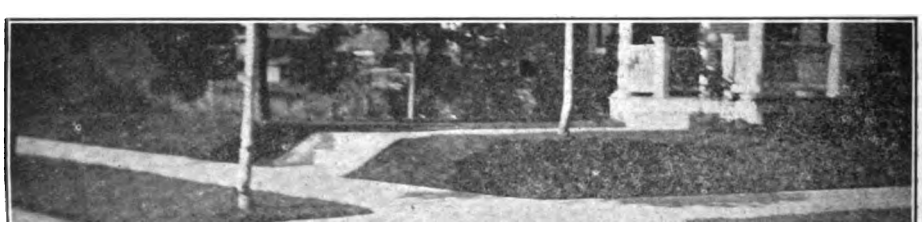
The above gang put in about 2,000 linear feet of the combined curb and gutter shown in the sketch. There is about 1.70 cubic feet of concrete per linear foot of curb, hence the 2,000 linear feet equals 126 cubic yards.

There were 88,000 linear feet of the curb and gutter in the contract and the contract price was 49 cents per linear foot. Excavation of trenches is paid for separately by the city on cubic yard basis as a part of the job if grading the street between property lines. The work of grading the street and of building curb and gutter and cross walls is all let in one contract.

Engineers reading this are cautioned about basing estimates on the price of 49 cents because the contract was taken at a time when work was slack and contractors hungry for work even at low prices to keep their men employed and their horses and equipment busy. It takes a trained organization experienced in the work to put in such a large amount as 2,000 linear feet of curb and gutter in 8 hours. The prices generally bid on this work range from 50 to 60 cents depending on length of haul of materials, labor conditions, and whether contractors are busy or not. The well equipped contractors average 1,400 to 2,000 linear feet per day of the curb and gutter work.

The view shows the good appearance of curb and gutter built as outlined above, i. e., without the regulation mortar facing.

APPEARANCE *of one-course curb and gutter on Denver street corner.*



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TRAFFIC CONGESTION PROBLEM

IN BROOKLYN, N. Y.

By W. H. Messenger, Assistant Engineer in Charge.

The many complaints of congestion of traffic in the Brooklyn, New York, streets, between Boro hall and the Brooklyn bridge, and of noise about the court house, caused a survey to be made of the conditions existing, of which survey the author was in charge. A method of relief by re-routing street cars, which were found to be the main cause of delays in passage of traffic, was proposed. The paper from which this article is taken was presented before the Brooklyn Engineers' Club and contains the details of the re-routing plan. This article sets out the principles of procedure and enough of the detail of the special case is retained to indicate how these principles may be applied in any particular case.

THE rather serious congestion and delay to all surface traffic in the downtown business section of the Boro of Brooklyn, caused by a combination of factors which the writer will attempt to set forth and analyze, has been forced on the attention of the public for some time past. The city planning committee has had the question under investigation for over two years, and the results of its inquiries have been publicly shown by a series of plans, which for their execution would call for very large expenditures both now and in the future.

The Boro president of Brooklyn has, of course, been very deeply interested in this question, and has given the problem to the chief engineer of the Bureau of Highways, Mr. H. H. Schmidt, who has made reports accompanied by plans, diagrams and statistics. The collection of the traffic statistics, together with the preparation of the plans and diagrams, having been given to the writer to do, he will try here to show the methods used, the data obtained as well as some of the measures of relief proposed.

The methods used were taken from those of the general traffic census of the Boro, and in order to best bring out these methods, a description of that census is given. The traffic census of the Boro was organized some three years ago for the purpose of finding the traffic density and tonnage thruout the Boro, as a guide in the design of pavements and for various other purposes. The locations at which observations were made during the year 1913, took in, as far as possible all the important and typical paved streets of the Boro. The work goes on thruout the year, with the exception of the months of January, February and March, when the weather conditions are generally such as to make the results that might then be obtained of very little value.

The records are taken by a corps of observers composed of one foreman and from 6 to 12 laborers, working rain or shine every day, Sundays and holidays only being excepted. The working hours are 8, from 8 a. m. to noon and from 1 to 5 p. m. Usually three records are taken at each location, with 15 day intervals between, so as to vary the day of the week. With the force available, from

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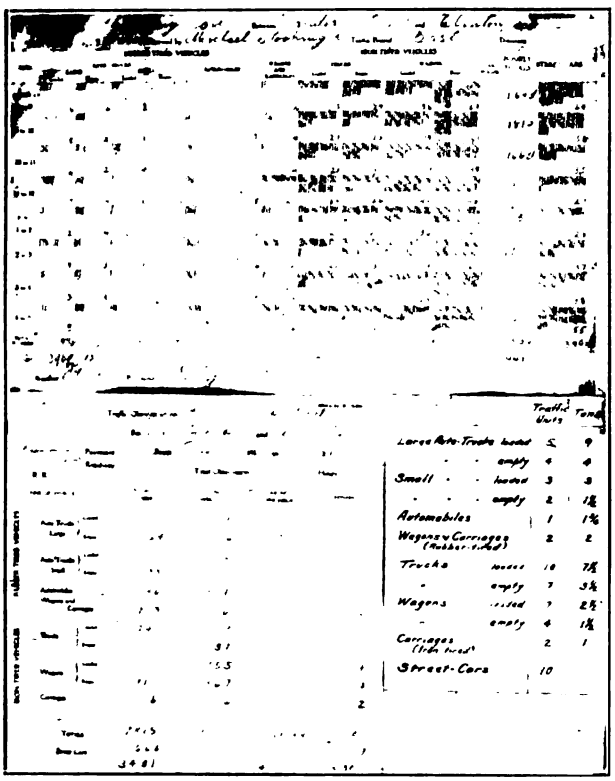

FIGURE I. *Enumeration of traffic units and tonnage for each class of vehicle enumerated, being a sample of an ordinary day's observation card and report summary.*

600 to 800 different locations are observed each year. The points of observation are so planned that a fairly accurate estimate can be made of the traffic density and tonnage in any given street or district. Where it is impossible to estimate by interpolation the data for a given street, special observations are made as required. While the largest part of all records are of 8 hours, some

analysis that will give an adequate measure of these quantities is of the first importance. Such a measure has been found and used in its work by the traffic branch of the London County Council. This measure is in the form of a factor or co-efficient, having a relation to the size, speed and flexibility of the vehicle, and is called a traffic unit. Applying each of these factors to the various classes of vehicles enumerated, a figure is obtained which, when reduced to the number of traffic units per hour or per minute per foot of available width of roadway, gives a reasonable estimate of the traffic density. In so doing this method also provides a common basis for comparison of the densities of traffic in widely different streets in the same city or in different cities and countries. The above reference to available width of roadway means the net width after deducting the width of the bases of elevated columns, isles of safety or any other fixed obstructions within the roadway.

The traffic tonnage, together with the class of the vehicles borne by the street, is of considerable importance in determining the character of the pavement to be used. Even where pavement openings are quite numerous, the wear and tear is a big factor in the life of the pavement, provided always that restoration after opening is done with a rea-

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port summary. The factors for traffic units, owing to the variable nature of the traffic and the intermingling of fast and slow vehicles, both loaded and empty, were not arrived at by computation but were established largely by observation. The figure 10 for street cars, owing to the size of the same and their being fixed rigidly in their line of travel, seems entirely reasonable. The same figure for trucks driving two or more horses might be considered large by some, but when it is remembered that this class includes a large variety of vehicles, such as moving vans, drays and trucks for lumber, coal, building and construction materials, frequently driving three horses, it is believed to be fair.

The weights used here are, of course, inclusive in every class of vehicle, including the weight of vehicle, the load, driver, horses, etc. The figure 9 tons for large auto-trucks loaded may appear to be rather above the mean for our heaviest class of motor-driven vehicle, but it must be remembered that there are a number of such vehicles in use with that number growing rapidly. There are a number of tractors with trailers now in use which weigh, with load, all told, 15 tons. It is necessary to thus dwell somewhat on these two tables, for upon them depends to a large extent the inquiry preceding pavement designs, based on a traffic census.

The assembling and indexing of the data secured are shown in Fig. 2. This index card gives a column for each of the quantities most used, except that of the percentage of motor-driven vehicles excluding street cars, which is placed in the remark column to the right. This card provides space for the entry of four or five years' records, thus providing a convenient traffic history of the street densities on a number of streets the widths of roadway of which do not even nearly correspond to some even multiple of 8. For instance, the roadway of Fulton street, between Boro Hall and Flatbush avenue, is 42 feet, of which two lines of street cars require from out-to-out, 19 feet, leaving 11.5 feet for passage of vehicles on either side. This space is more than ample for one line of traffic on each side of the street cars, but not sufficient for two lines. In other words, the width of the roadway in excess of 34 or 35 feet is of so little value as to be negligible. Before the advent of our largest street cars and the increase in size of almost all other vehicles there may have been room for six lines of traffic in this roadway space provided for us by our ancestors, that is, if they gave such a matter any thought, which is doubtful. Nowadays, however, for such capacity a width of at least 50 feet is necessary. A glance at Livingston stret in the same vicinity shows this to be unquestionable. This, of course, brings out the fact that if Fulton street could have its roadway widened 4 feet on each side, for instance when the elevated railroad is reconstructed, an additional line of traffic in each direction could be accommodated, to the very great benefit of the public, particularly that fairly large portion of it doing business in the vicinity.

To revert once more to tonnage, it has

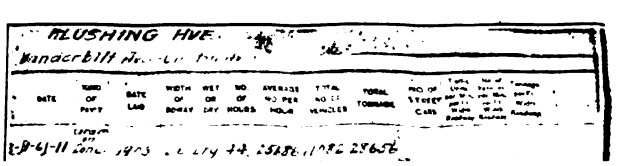

FIGURE II. *Index card, giving summary of data for point on Flushing avenue, affording room for records for several years.*

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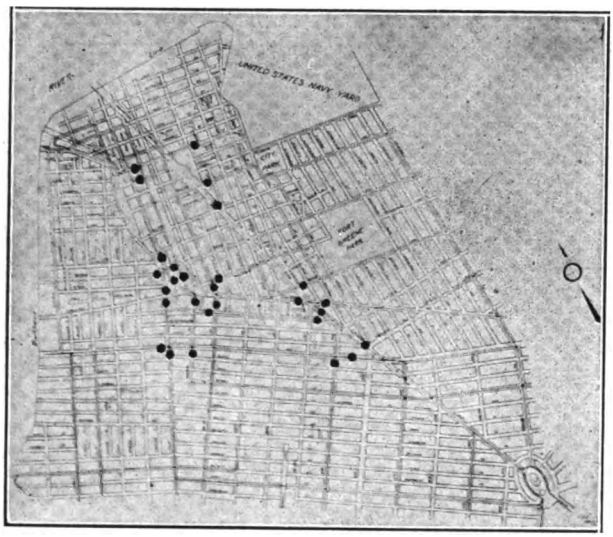

FIGURE III. *Map of the Brooklyn down-town district, the black dots showing the points of observation of traffic conditions.*

become quite the custom by some to refer to certain classes of pavements as being suitable for so many thousand tons per foot width per annum. It seems rather premature to attempt to make such an assumption until it has been proven after the lapse of the necessary time, that such pavement has actually lived its normal life under such a traffic. In other words, it would seem to be far safer to wait until we have a complete history of the given pavement which has actually worn out, especially its traffic-tonnage, before we can assume either the tonnage a given pavement will bear most efficiently, or the pavement most suitable for a given tonnage.

On some streets, due to width of roadway or location of and kind of street car rails, vehicles have a tendency to keep to one line, thereby gradually forming ruts, tending to the quick destruction of the pavement surface. This can hardly be avoided, but can be somewhat ameliorated by laws which fix the maximum loads per axle and the minimum widths of tires and diameters of wheels.

With some regard for the foregoing, we will now look at the special problem of congestion of all traffic in downtown Brooklyn. This problem was brought up very forcibly by the request of the court house commission that all street cars be eliminated from Joralemon street between Court and Fulton streets and from Livingston street between Court street and Boerum place. At or about the same time the proposition was advanced to remove the elevated railroad entirely from lower Fulton street, turning it into Adams street at about Boerum place and running thence to the present turn into the Brooklyn bridge terminal north of Tillary street. This will probably call for a double-deck structure from Myrtle avenue northerly. Adams street it is proposed to widen by taking about 100 feet on its easterly side. To make this 'L' turn it is proposed to take a part or all of the small triangular block between Fulton, Willoughby and Pearl streets. Of course, this whole proposition is part and parcel of the proposed improvement of the district between Boro Hall and Brooklyn Bridge. But with regard to surface traffic strictly, it may be possible to meet the desires of the court house commission and also partly remove the existing congestion and delay in this vicinity. To study this question properly, we, first of all, took a series of 16-hour traffic records at a number of important points in the district affected. These observations were taken between 6 a. m. and 10 p. m., subdivided into 15-minute intervals, the observers working continuously, in two shifts, two men at each point per shift. The points of observation are shown on the map of the downtown district by circles, Fig. 3. From these data, collected on a form shown in Fig. 4, were obtained the route and destination of every street car passing thru the district in each direction as well as the ordinary vehicular census. After computation of the results and plot-

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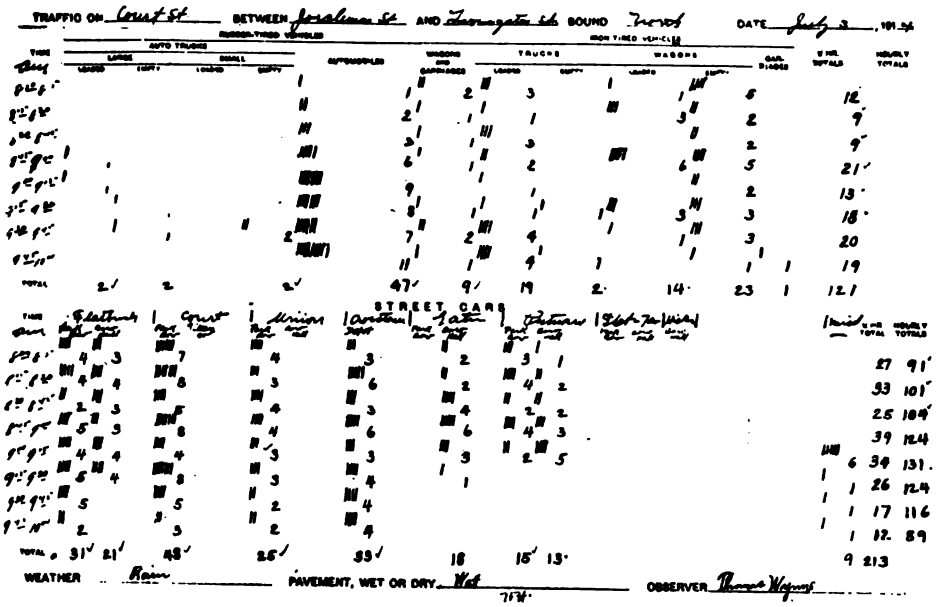
TRAFFIC ON Court St BETWEEN Joralemon St AND Livingston St BOUND North DATE July 3, 1914
AUTO TRUCKS
AUTOMOBILES
TRUCKS
WAGONS
STREET CARS
TOTAL
WEATHER Rain PAVEMENT, WET OR DRY Wet OBSERVER Thomas Wagner

FIGURE IV. *Traffic count in Court street, showing route, direction and destination of every street car passing, as well as number of each class of vehicle.*

ting of the same we were in possession of the data to show the location and hour of greatest traffic density. This inquiry was supplemented by a few photographs, as follows, Fig. 5 being the first of these and indicating the nature of the information furnished by them:

Flatbush avenue, from State street to Fourth avenue, looking north; Flatbush

FIGURE V. *Photograph of Flatbush avenue from State street to Fourth avenue, indicating the nature of information given by photographs taken at listed stations.*

January, 1915.

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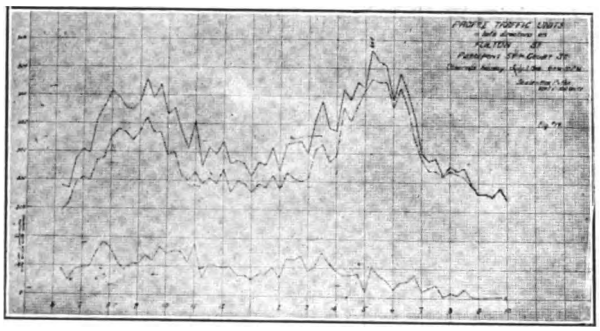


FIGURE VI. *Profile showing number of traffic units passing in each direction on Fulton street, from Pierrepont to Court street.*

avenue and Nevins street, looking north; Court street, from Remsen street to Joralemon street, looking north; Flatbush avenue, from Pacific street to Fifth avenue, looking north; Fulton street, at Bridge street, looking west; Fulton street, at intersection of Adams and Willoughby streets, looking west; Atlantic avenue, from Flatbush avenue to Fifth avenue, looking west; Court street, from Joralemon street to Livingston street, looking north; Court street, from Montague street to Remsen, looking north; Fulton street, at Pearl street, looking west; Fulton street, at Myrtle avenue, looking north.

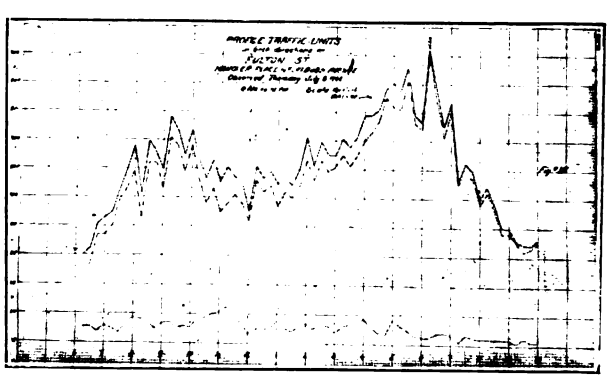
From the data thus obtained an analysis of the density and direction of all traffic was obtained and its control studied, first to obtain the particular results required by the court house commission, and second to reduce the congestion at certain important points; all of which must be done, of course, without serious reduction of the facilities now given the public nor at any very great expense.

From the profiles shown, it is easily seen that the congestion problem is one of street cars, the ordinary vehicular traffic being insignificant in comparison. From the rush-hour data is obtained a table of street car movements in both directions about as shown in Fig. 9. These are in numbers only, and in the adjoining column are the approximate figures obtained from the re-routing of street cars to overcome the difficulties complained of.

From the table in Fig. 9 we see the number of cars now passing the points given in both directions from 5 to 6 p. m. and in the adjacent columns the number called for by the proposed re-routing, together with the differences in number and percentages of reduction or increase as the case may be. By profiles it has been demonstrated what a large proportion of the total traffic density is due to street cars, therefore it seems fair to claim that a material reduction in numbers of the latter will achieve the desired result.

While the reduction of the amount of street car traffic at the most essential points may seem niggardly in this proposal, attention is drawn to the elimination of certain very bad intersections now existing, where it is believed a very material improvement can be expected.

FIGURE VII. *Profile of traffic units passing in each direction on Fulton street, from Hanover Place to Flatbush avenue.*



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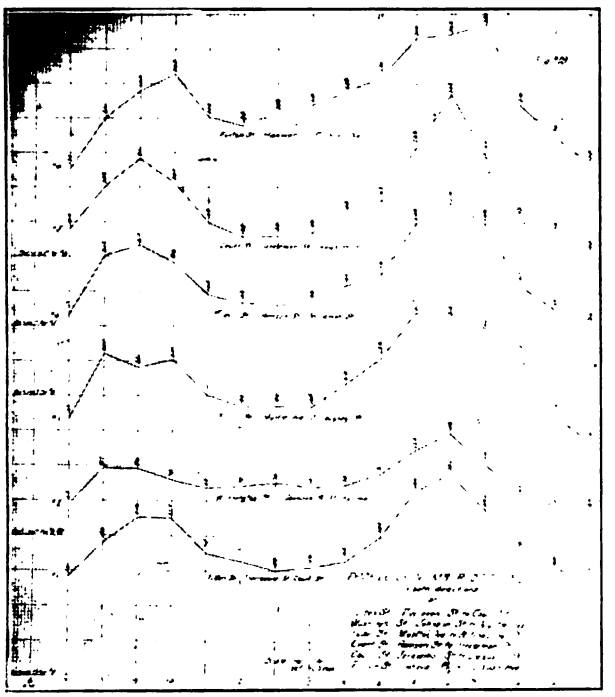

FIGURE VIII. *Profile of the number of cars passing in each direction on six streets on which observations were taken.*

Referring to the map, Fig. 3, the present crossing at Joralemon, Fulton and Willoughby sts. will be removed, as well as that at Fulton and Adams sts. and Boerum pl. The remaining northbound Park Row cars on Fulton st. between Myrtle ave. and Willoughby st. will continue straight north on Fulton st. instead of dividing as now, some proceeding north on Washington st. The third track on Court st. at Boro Hall likewise disappears.

Naturally enough these not be difficult for the railway men and the city authorities to come to some agreement on the matter, equitable to all. Also this plan does not wait for the very large proposals for an approach to Brooklyn bridge to be worked out in their full detail. This plan does, however, offer a solution that can be quickly utilized as soon as the court house and elevated railroad problems are determined.

As regards this surface transit problem in general it is believed to be no worse than that encountered and solved in several other cities, of even much less population. The beginning of the now very comprehensive rapid transit system of Boston was the placing of its street cars in a subway under Tremont st. thru the center of the city. The city of Newark, New Jersey, has been able to obtain the construction of a large terminal for the relief of the public and better street car operation thru its streets.

FIGURE IX. *Table showing number of cars passing in each and both directions at fifteen points of observation and the number that would pass under re-routing plan, with increase or decrease in each case.*

Street	Limits	Existing			Proposed			Diff.	Remarks
		North Bound	South Bound	Total	North Bound	South Bound	Total		
Fulton St	Fairchild - Court Sts	119	173	292	93	109	202	89	90
Washington St	Johnson St - Myrtle Av	101	48	149	67	53	120	29	17
Boerum Pl	Fulton St - Livingston St	37	42	79	87	60	147	-68	-86

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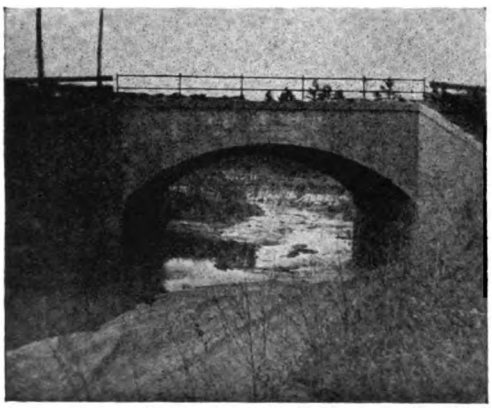

Concrete bridge built by Fulton county, Georgia, convicts. Forty feet span, sixty feet width.

CONVICT LABOR ON COUNTRY ROADS

By George C. Warren, Boston, Mass.

The arguments in favor of using county jail and state prison inmates as laborers on construction and maintenance of country roads are forcibly put in an article prepared for the General Federation of Women's Clubs, from which this article is taken. Fulton county, Georgia, work is set forth in some detail because the author has means of knowing how that work is done.

IN these days of modern improvement, perhaps there is no economic question of greater importance or receiving more earnest consideration than that of more humane, industrial treatment of the unfortunate convicts and of making them more useful members of society.

The evils of contracting convict labor at low prices to manufacturers for producing goods for sale on the market, in competition with similar products manufactured by free labor, which was in general vogue in our State penitentiaries and county jails, have come to be well recognized and the practice quite gen-

a period of maintaining the convict either in absolute idleness or not permitting him to perform work in the production of articles of which he can see a use. This is still the practice in many institutions. About twelve years ago it was the writer's privilege to spend a half day under favorable auspices in going thru the Elmira (N. Y.) Reformatory, which had the reputation, doubtless well earned, of being one of the best managed reformatories in the country. It was heart-rending to see the convicts taking their daily exercise, marching in line, back and forth thru the prison yard. The

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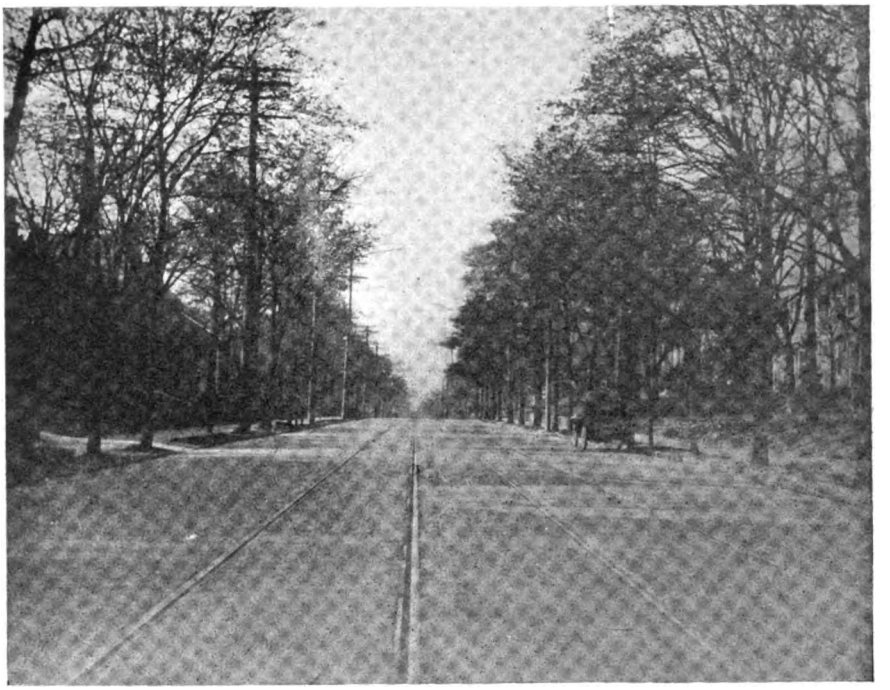

PEACHTREE STREET, *near Eighth street, Atlanta, Ga., paved with bitulithic by Fulton county convict labor.*

an hour or so was over and before returning to their cells, the men would empty their pockets into a receptacle for the purpose. How nearly useless and how degrading is such employment! No work for production of goods for sale was permitted under the law, but the effort was made to teach men trades—carpentry, brick masonry, blacksmithing, etc. The men learning masonry, for instance, would one day build a wall about ten feet long and ten feet high, which the next day they would tear down and rebuild, going thru this operation in a little enclosure day after day. Could anything be designed which would be destined to cause a greater loathing for the brick mason's trade thus taught, than this perpetual accomplishing no useful end other than the mechanical education which, being enforced, the average convict probably does not appreciate?

But the most pitiable condition is when the convicts are released, after months or years of close confinement, as is still the custom in most of the penal institutions of the country, in a nearly dark, poorly ventilated cell; released with a grudge against the world; sullen in temper; sallow in complexion; broken down in health from sedentary habits and lack of work; given a very poor uniform suit of clothes, a few dollars in his pockets and thrown on the world, generally without friends, to find a job. The first question asked of an applicant for work is reference to his last employer. He must either lie, and probably be caught in the lie, or face the fact that ninety-nine times out of a hundred the prospective employer, even if he had a job to offer, will not trust it to a convict.

Is it any wonder that convicts, released under such conditions, take the little money given them by the State on release, and either make straight for the saloon or gambling den, if that has been their past infirmity, or use it to get a supply of burglar's tools, if their past efficiency has been along the burglary line?

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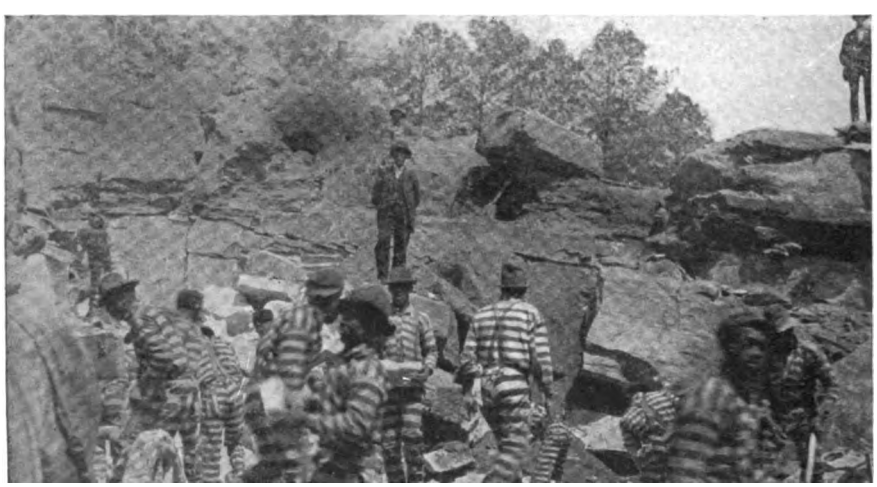
As a result of the general introduction of automobiles, both for pleasure and business purposes, with their destructive effect on the old types of road, the country is fast awakening to a realization of the fact that the country roads of the future must be as substantially built as city pavements.

In fact, the narrow country-road thorofare today carries a greater traffic per foot of width of improved area than fully three-fourths of the wider streets of any city. Congress has just passed a bill appropriating $5,000,000 per annum as a national aid to maintenance of State roads, but that large appropriation is not a drop in the bucket. The National Highways Association is energetically advocating the building by the Federal Government of 55,000 miles of highly improved country roads, including several stretches from the Atlantic to the Pacific, and from Canada to the Gulf of Mexico or Mexican border. Such national highways it is proposed should be built, maintained and owned by the Federal Government, leaving the states, counties and townships to build feeders into the national highways. Such a system of national highways, if well built, would cost approximately $800,000,000.

The state of New York alone has just completed the expenditure of an appropriation of $50,000,000. With this vast expenditure the New York State roads are as yet scarcely scratched over. Generally speaking, the work done has proved unsatisfactory and is rapidly deteriorating because it has been done too cheaply, in an effort to make the expenditure go as far as possible—much farther than it can be spread to meet the exacting conditions of the modern motor car and motor trucks.

Other states are rapidly adopting appropriations of corresponding large amounts as New York.

This immense development of modern country road construction and maintenance is a new industry—one for which a vastly increased amount of labor is



QUARRYING ROCK *in excavation for forty-foot roadway, with twenty-foot cutting, with Fulton county, Georgia, convict labor.*

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GRADING *country road in Fulton county, Georgia, by convicts.*

being required. It, therefore, does not compete with present employment of labor. Labor thus employed is not in the manufacture of articles for sale and thus put in competition with the product of other laborers. The national, state, county or township roads are built at the expense of the public, for the public use, and not for sale to anyone. What more fitting employment could there be for convict labor as far as such convict labor is available? On such employment the men would have good air, good useful exercise, and could each day see the product of their labor performing a use, which is a most important consideration to the moral welfare of the men after they have completed their sentences. On release they will have learned a trade at which they can immediately get employment on other roads without the ignominy of being asked where last employed. With that fair start each man would advance on his merits with his new employer and his past employment would be forgotten. In short, the ex-convict would be given a fair chance and a new start in the world, which he never can get under the convict system now in vogue.

This is no idle dream. It has been practically tried out in Colorado, New York, Washington, Oregon and other states, to a sufficient extent to prove beyond peradventure that it is practicable. In many cases, where the convicts are put on their honor, they respect the honor and become better and more industrious convicts and are destined to become better citizens on return to freedom.

Reports are published that in Missouri and elsewhere a certain amount per day of employment of the convict is paid to his family, so that he is thus enabled to contribute to the support of his family while in confinement. What an immense advantage that is to the convict's moral condition!

I don't know that it has been tried, but it seems to me entirely practicable to set aside for the benefit of the convict a certain amount of money per day of time employed while under sentence. It is suggested that the amount should be a reasonably full measure of the value of his service, less the cost of his support in confinement. Under wise supervision portions of such earnings should go to the family of the convict, if required for their reasonably comfortable support, and as much as possible set aside in a savings bank at interest so that when the convict is released the head of the penal institution can say to him, "You have been industriously employed....days and earned over the cost of your board $.....of which $.....has been given to your family for its support and here is a savings bank account for $.....covering the balance with interest. Engage yourself in some useful employment and the Lord will be with you in your effort to be a useful, industrious member of society." Contrast such a release with the present custom of setting an ex-convict adrift with a poor

CONVICTS *in Fulton county, Georgia, spreading Warrenite road surface.*

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suit of uniform cloth, which immediately marks him as an ex-convict, and five dollars in his pocket with which to find his bearings.

An interesting article in the *Century Magazine*, entitled "The Next Step in Prison Reform," gives in detail a most interesting plan adopted in the Ohio State Reformatory under which convicts who are believed to be worthy of the trust are given employment on the prison farm, without physical restraint. When thus put on the farm the convict is handed a bond signed by the convict as principal and by the general superintendent of the reformatory as surety, the conditions of the obligation being as follows:

"Now if the said John Doe, Serial Number 5656, shall well and faithfully execute the trust thus reposed in him and shall observe and obey all the rules and regulations governing said trust, then this obligation with all penalties provided for in the rules and regulations shall be void, and on the release of said John Doe on parole from the Ohio State Reformatory, he shall be given this bond to keep and to hold as positive evidence to all concerned, not only of his good record as an inmate of the reformatory, but that he enjoyed the confidence and faith of the management on the grounds that in all things he conducted himself as becomes a man and a good citizen.

Witness our hands this 20th day of November, A. D., 1913.

John Doe,
(Principal.)
J. H. Leonard,
(Surety.)

Bonds like these are used when permitting an inmate of the reformatory to join the group of men who are employed without any physical restraint whatever, that is, when a man undertakes to regu-

ROLLING *Warrenite road surface in Fulton county, Georgia, using convict labor.*

"In giving you this pass, I give you my confidence. I am sure you will fully appreciate this opportunity to demonstrate not only to me, but to the board of managers and to your friends who await your restoration to freedom that you have the self-control, the respect for law, and the proper regard for your word of honor that justifies us in permitting you such a large measure of freedom. Remember, when tempted, that trustworthiness is the red-book of character."

It is reported by Mr. Barry that:

"During the ten years that the system has been in operation in the Ohio reformatory twenty-six hundred prisoners have been allowed to work in the open without guard. Only eighteen have ever attempted to escape. The others preferred their healthy, interesting work in the open, and the bond and the card."

Fulton county, Ga., surrounds and includes the city of Atlanta, as Allegheny county, Pa., surrounds and includes Pittsburg. On account of the large assessed valuation of these large, enterprising cities, the counties are highly favored in the moneys available for road construction and maintenance, in conse-

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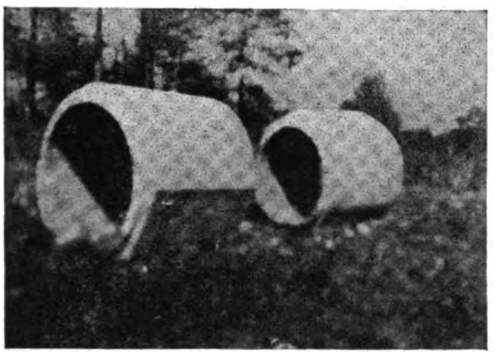


REINFORCED CONCRETE PIPE, 48 *inches in diameter, made by Fulton county, Georgia, convicts.*

construction in Fulton county, which not only includes the building of roads, but also the quarrying of stone for use in the roads and concrete construction, the building of concrete bridges and bridge abutments, laying of sewers, manufacture of cement concrete pipe, street grading, etc. In short, everything which is required in high-class road construction which can be built locally.

The writer is indebted to Mr. W. T. Wilson, C. E., engineer of Fulton county, for a series of photographs incorporated with this article, illustrating the convicts at work and the completed works constructed by convict labor.

It will be noticed by the photographs that in this case the convicts are all negroes and are in the usual striped uniform of penal institutions. It has been claimed by some that the striped clothing and their marking of the men is degrading and unnecessary. This is a matter of detail which could be easily changed if best and safe. Perhaps in this and other respects different treatment of white men in the North can be practiced than is practicable with colored convicts of the South. However this may be, there can be no question that, whatever the clothing, work on the public highway is far less degrading than idleness in a prison cell. Fulton county has several camps in different sections of the county where the convicts engaged in road construction are fed and housed in tents.

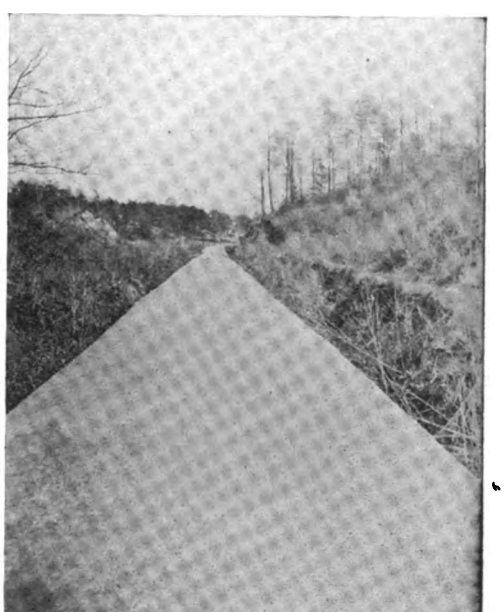
On the question of white vs. colored convicts, Mr. Barry, referring to a case of extreme cruelty practiced in a prison in Richmond, Tex., thru dark cell incarceration and flogging, says necessity for the treatment was claimed by the authorities because "the negro criminal was more difficult to deal with than any other kind, that he was less amenable to reason or restraint, and that he could be reached only thru his epidermis or his primitive imagination, which recoiled at the dark."

If it is true, as thus claimed, that negro criminals are most difficult to deal with, then Fulton county has solved the problem of outdoor employment under the most difficult conditions.

The following facts are gleaned from the most interesting and valuable "Annual Report of the Chairman of the Board of Commissioners of Roads and Revenues of Fulton County, Ga., for year ended December 31, 1913, by Shelby Smith, Chairman Board of County Commissioners":

"There had been an average of 680

CONCRETE SEWER *of fourteen feet diameter, built by Fulton county, Georgia, convicts.*



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male convicts under control of the county during the year 1913, and they have been engaged on the public works of the county and the city of Atlanta....The total estimate of work done by the department amounts to $766,340.87."

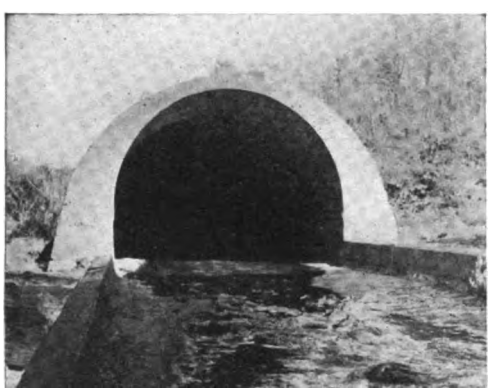
The amount of work of several classes by the employment of convict labor during the year 1913 is officially reported as follows:

Roads graded during 1913, 16.9 miles, and miscellaneous grading, at a cost of.....	$105,404.98
Roads paved during 1913, 9.13 miles, at a cost of.....	185,007.65
Roads resurfaced during 1913, 3.55 miles, at a cost of.....	10,152.10
Roads oiled during 1913, 50.64 miles, at a cost of.....	27,427.92
21 bridges rebuilt and repaired during 1913, at a cost of....	7,744.93
General road repair.....	49,640.00
	$385,377.58

"Of a total of 640 prisoners confined for month or period ending December 24, 1913, there were only four under the care of the physician."

"The Board authorized the committee on public works to install shower baths at the county barracks for the use of the convicts."

OUTLET *of trunk sewer of fourteen feet diameter, built by Fulton county, Georgia, convicts.*



The National Free Labor Association, having its offices at 832 Broadway, New York, has published a 50-page bulletin, "Road Making by Convict Labor," which contains a series of extremely interesting articles and statistics and excerpts from reports and laws on this important subject. The following extracts are of special interest: An article by Julian Leavitt, "Good Roads and Better Men," contains the following:

Good roads are a crying necessity in this country. But until now the cost of building them has been prohibitive. We have scarcely begun to realize that in our 1,400 prison houses we have stored the labor power of 100,000 men and boys, truly an army of liberation if only applied to good purpose. I have shown elsewhere how this great mass of human energy is permitted to degenerate in the cell until it poisons not only the immediate victim, but the rest of society. Now let me tell a pleasanter story of how a few wise administrations have begun to harness this force to a great communal purpose."

Then follows statistical information from Colorado, Montana, Oregon, Maryland, Georgia, Louisiana, New York, New Jersey, Arizona, Missouri, Kansas, California, Ohio and Vermont, all of which states have successfully tried out the employment of convict labor on the country roads. The article concludes with the following:

"Here, then, is a complete road program for any state:

"First, abolish the contract system, both in the prison and on your roads.

"Second, classify your prisoners into three groups.

"A. The honor group, consisting of trustworthy, good-conduct men, whose

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long and far distant from expiration date —i. e., men to whom the temptation to escape may appeal powerfully, but who have demonstrated some capacity to resist it.

"These men may be put on road work in the vicinity of the prison.

"C. The remainder, who cannot be trusted.

"These men may crush rock and prepare the road material for the use of the other groups, but within the prison walls.

"Third, organize your road forces with the advice and under the superintendence of competent road engineers from the State Highway Department.

"Fourth, co-operate with the county authorities by exchanging prison labor for county food and equipment."

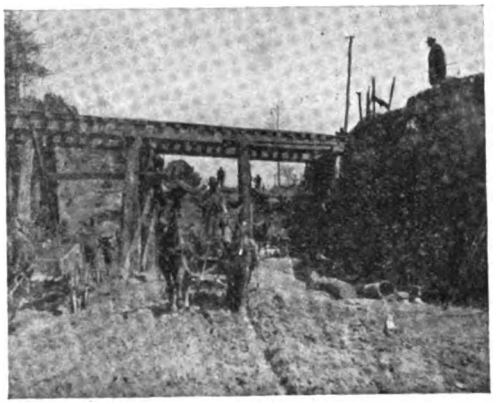
An article, "Solution of the Convict Labor Problem," contains the following:

"At its biennial convention in 1912, the General Federation of Women's Clubs passed a resolution declaring itself 'as opposed to the contract system of prison labor, and to every other system which exploits this labor to the detriment of the prisoner; and that we urge upon the several states the advisability of establishing outdoor work for able-bodied convicts, remedial care for the feeble and degenerate, and industrial education for all who have the potentiality for reform ....The product of the convict's labor should be consumed by the state, and the profit therefrom, above the just cost of his keep, should be used to support such dependent family as he may have."

The New York State Commission of Prisons reports:

"Your committee believes that road building by the convicts, if it receives the co-operation of the officials and the men in charge, can be made profitable to the county and town, and at the same time show earnings for the penitentiary greater than heretofore shown."

Col. Edwin A. Stevens, State Road Commissioner of New Jersey, after one season's trial of convict labor on the roads of his state, is enthusiastic in endorsing the policy generally. In a communication to the A. A. A. National Good Roads Board, the Commissioner writes:



ELIMINATING GRADE CROSSING *by lowering grade of highway, work done by Fulton county, Georgia, convict labor.*

"The experiment of convict labor on state roads, which was proved to be a success in one week, is only the beginning of good road building beyond what we already have and at a price which will spread out the money of the state beyond its present confines."

The attitude of organized labor toward road building by convicts is shown by the following facts:

President Gompers, of the American Federation of Labor, says: "Prisoners should be employed at useful and practical productive toil. The labor of the state's unfortunates and derelicts should never be exploited for profit, and certainly never for the private profit of contractors. Let our states employ their prisoners in the production of the necessaries of life, for the maintenance of themselves and the inmates of the other state eleemosynary institutions, or else road building."

John J. Sonstesy, of the United Garment Workers, in the Proceedings of the National Conference of Charities and Correction, 1912, page 222, says, in regard to the question of road building by convicts:

"Many people think that the only alternative to abolishing the contract or lease system is idleness for the convicts. That this is not true has been proved in the places where the contract and lease

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systems have been abolished. Every convict who has no trade and is capable of learning one should be taught one most suitable for him to make him an efficient, intelligent mechanic, and able to follow the trade when he is released. In the arrangement of employment for the prisoners the state should endeavor to supply itself with everything necessary in its various institutions. A large farm should be operated, and all other necessary plants for the turning of the different raw products into the finished articles needed in the various state institutions. The making of roads is an ideal occupation for convicts."

The New Jersey Federation of Labor passed the following resolution:

"Resolved, That the New Jersey Federation of Labor urges upon Fielder, so far as he is able, to develop the state use and road work system, and so far as possible continue the policy laid down by his predecessor, President Wilson, on this important subject, and they request him to refuse to renew or execute any new contracts for the work of prisoners or permit the present contracts to be extended."

John P. Frey, of the International Molders' Journal, says:

"The trade-unions have never advocated that convicts should be kept in idleness, instead they have insisted that convicts should be employed and that the convict's reformation would be impossible without useful and healthful labor...

"It is not the work of the convicts as producers which meets with trade-union opposition, or that by working they may keep some free men idle. It is the methods by which prison labor, when performed for the benefit of private contractors, places the convicts' labor on the market, and thereby forces reductions in wages upon large numbers of free workmen and, by so doing, lowers their standard of living.....

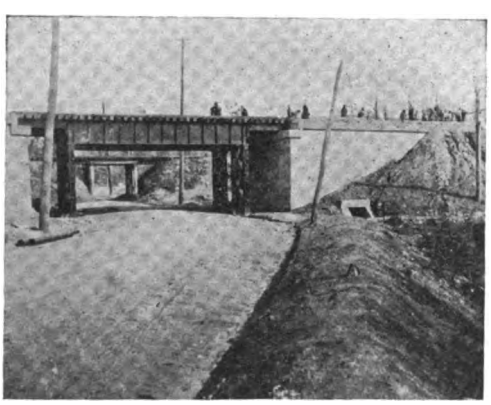
"For years the trade-unions have endeavored to have the convicts employed out of doors as much as possible, where the sunshine and pure air would build up the physical man and give that rugged health which would enable the unfortunates upon their release to have clear heads and strong bodies, instead of being the pallid wrecks which so often leave the prison door, nerveless, spineless and unfit to undertake the task of reclaiming their places as useful members of society or to properly support themselves thru their labor.

"The trade-unions insist that convicts shall be employed, but they are equally insistent that their labor shall be performed under conditions which will tend primarily toward their reformation....

"There is much work requiring the use of both brain and hands which is necessary in connection with the maintaining of our state and eleemosynary institutions which could and should be done by convicts. There are highways to build, there is farm produce to be provided and the convicts can do all of this with a minimum of competition with free labor and with no injury to the farmer.

"For this work the convict should be paid by the state so that he may be made to realize that the state does not rob him of his labor, a common impression among the convicts today, but that his confinement has been made necessary for his own good and the safety of society, and that during this confinement society is discharging its obligations to him, giving him an opportunity of reformation, end enabling him to earn money which will save him from actual

CONCRETE ABUTMENTS *built by Fulton county, Georgia, convicts in eliminating grade crossings.*



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want upon his release, and what is equally important, enable him during confinement to provide for those who are dependent upon him and who without his assistance are forced in many instances to depend upon private charity."

Referring again to Fulton county, the experience proves that the very highest and most modern types of road construction requiring expert labor and technical skill can be built successfully with convict labor at a minimum cost. The types of road which can be most economically built by convict labor are those which are made as largely as possible of crushed rock. The manufacture of road materials at penitentiaries, shipping the materials thus manufactured by rail to point of use, is undesirable and uneconomical because:

First—Such types of roads require an undesirably heavy investment in manufacturing plant.

Second—An unnecessary and heavy outlay of cash is necessary in transportation of the manufactured product from the penitentiary to the point of use.

The entire tools and machinery of Fulton county employed by its public works department, including quarry and street tools, wagons, grading outfits, steam rollers and complete Warrenite mixing plant, is inventoried at only $50,500, with which, as noted above, it completed public works in 1913 aggregating $385,377, so that the road construction of 1913 aggregated nearly eight times the value of equipment used thereon.

Of course, it must be borne in mind that convicts who are physically incapacitated, either because of age or other infirmity, or because of lack of prior muscular development, cannot be well put at manual labor. As someone has said: "You cannot suddenly turn a bank president into a laborer with a pick and shovel, and expect him to perform much work." In road construction, ever, there is a great deal of employment which is not manual labor, such as time-keepers, material men, watchmen, etc., and it is believed that, as in the business world of free labor, a place can be found on road construction for all classes of convicts, each placed in the department of the work which he is best fitted to fill.

In conclusion, if the entire 100,000 men and boys reported to be now confined in 1,400 prisons, distributed thruout the United States, were employed in road construction, the number so employed in most of the communities would be but a small proportion of the total labor required, and would be so infinitesimal in its effect on free labor similarly employed as not to be felt.

"Organized labor," freely quoted above, is to be congratulated in the humanitarian attitude it is now generally taking in favor of the employment of convicts on outdoor work, preferably on country roads.

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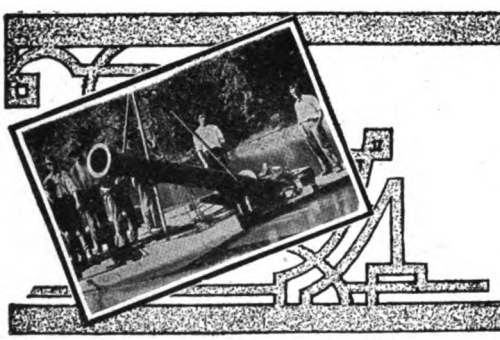

EDITORIAL

BUILD NOW.

The evidences of early resumption of activity in all lines are increasing in number every day and it is the duty of the managers of business of all sorts to prepare for the rush which will soon follow the opening of the gates. The present inactivity has thrown many men out of work and the depression has affected the prices of construction materials of nearly all kinds, so that the present is the best time for placing contracts including both labor and materials which this country has seen for many months, and the best which it will see for some years in the future.

Prices and terms are the lowest and best possible, and it is only common business foresight to take advantage of them. Notwithstanding the exceptional reasons for a foreign demand for money, there is plenty of money available, perhaps at a reasonable increase in rate of interest, for legitimate enterprises. It really seems that most corporations have money on hand or readily available for whatever seems to be legitimate expansion. It takes only a little courage to back the conclusion, which must be drawn from a study of the demands of the near future in the light of the present conditions, that within a very few weeks business will open with a vigor which will tax all present facilities and demand more.

Economy demands that advantage be taken of the present low prices of construction materials and labor to make the additions to present buildings, machinery and supplies, so that when the rush does come and neither time nor men are available and prices of materials have begun to soar, the plant will not be swamped and the profits will not be cut off because of lack of room and facilities for handling the business.

Every great war has been accompanied or followed by a great increase in business activity and, so far as the United States is concerned, the effect of the present war is already felt in this direction.

Municipalities in particular should take advantage of the present conditions for the same reasons and for two other reasons, equally good, tho not so lasting. One of them is that the city may give employment to those who are now out of their usual line, and available at lower prices than usual for city work. The other is that, while cities usually do not have the money in hand to pay for work, they can at this time raise money on

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MUNICIPAL ENGINEERING can hardly fail to chronicle the adoption of plans for and the beginning of construction of many extensions of present plants and new public and private improvements in the February number, and fully expects its annual spring construction number to be the largest and to show the most extensive prospect of work for the season which it has ever found to record.

HOME RULE FOR CITIES.

An Englishman, William Harbutt Dawson, has recently published a book on "Municipal Life and Government in Germany," which compares the practical home rule of German cities with the carefully supervised governments of English cities to the advantage of the former. It appears that the central government has equal power in the two countries over the detail of the operation of cities, but the German government seldom exercises its control except in matters directly concerning the central government itself or its national political policies, whereas the English government, thru various national boards and thru Parliament itself, interests itself in the smallest details of the administration of its cities and keeps them in such close lines of action that they may almost be said to have no actual powers of their own.

German cities are subject to all the difficulties arising from bi-cameral city councils, entire independence of appropriating and spending authorities, interference of councils with appointments to office, and, on occasion of interference of the state government with all these matters, from which American cities have been trying to free themselves by means of centralization of power in the mayor, the commission form, the city manager, the commission-city manager and their numerous modifications, but by the application of three principles they have been able to develop what is perhaps the most efficient of city management, if judged by results. These three principles are: The separation of municipal elections from partisan politics so that the city council and all officers are selected without control by any political organization; the selection of the administrative officers by a strictly merit system, with the result that municipal office holding is as much a profession as teaching, and officers are selected from any locality within the empire where the most competent and most suitable men can be found; and the practical operation of home rule, which, when properly applied, includes both the other principles.

American cities will do well to study the application of these principles in their own government, as exemplified by the German cities, and may then discover that the true course of improvement in municipal conditions is not so much in the change in form of government as in the full application of these three principles, all of which are recognized by the students of these problems, but none of which have had their full opportunity to demonstrate their value in our own cities.

The annual report of the Director of Public Works of Philadelphia, Morris Llewellyn Cooke, published last summer, is unique in its manner of discussion of the problems of city management and shows many of the lines in which the principles stated can be and should be applied, and reports the measure of success which Philadelphia has attained where it has been permitted to apply them.

Both these publications are well worth the detailed study of those whose hearts are in the search for a solution of our municipal government problems.

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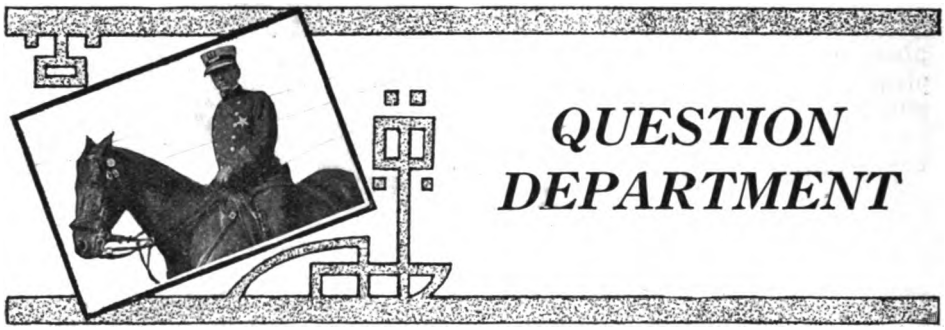

Articles on Good Roads

I would like a list of the articles on good roads appearing in MUNICIPAL ENGINEERING during 1914.

P., Washington, D. C.

Following is a list of the principal articles on roads and streets which appeared in MUNICIPAL ENGINEERING during 1914, those on pavements having close relation being included, as street pavements are now required on many main highways.

In vol. xlvi:

January: Paving Methods in Baltimore, p. 2; New York State Highway Specifications, p. 33; Highway Maintenance in Indiana, p. 34; Stone-Gravel Roads Costs, p. 52; Asphalt Pavements in Buffalo, p. 56; Brick Pavements in Buffalo, N. Y., p. 58; Motor Trucks in Street Work, p. 59; The New York State Asphalt Inquiry, p. 67; Creosoted Wood Block Paving in New York, p. 71; Pavements of Rome, N. Y., p. 84.

February: Pavements of Trenton, N. J., p. 102; The Relative Economy of Constructing Bituminous Pavements by Penetration Methods, p. 146; Report on Concrete Roads in Wayne County, Mich.; The Construction of Creosoted Wood Block Pavements, p. 152; Economical Plant for Handling Gravel for Road Building, p. 153; Cutting Down Hauling Costs, p. 165; Asphalt Pavements in New Orleans, p. 177; Trinidad Asphalt Streets in Indianapolis, p. 179; Aztec Asphalt Pavements in Scranton, Pa., p. 182; Permanency Is Keynote in Modern Road Building, p. 184.

March: Motor Dumping Trucks, American and German types, p. 202; Aggregate for Concrete Roads, p. 213; The Maintenance of Concrete Roads; Methods and Cost of Repair, p. 217; Building and Maintaining Roads for the Traffic, p. 234; The Importance of Highway Maintenance, p. 259; Method of Constructing Concrete Pavement, p. 261; Tarred Concrete in Portland, Me., p. 265; Aztec Asphalt in Baltimore Pavements, p. 280; Fifth Avenue Pavement in New York, p. 282; A Portable Plant Laying Asphaltic Concrete Pavement, p. 289.

April: The Municipal Asphalt Paving Plant of Spokane, Wash., p. 304; Bituminous Pavements in Wilmington, Del.; Concrete Alley Pavements, p. 311; Methods of Paving Construction in Baltimore, Md., p. 326; Brick Pavements, Their Maintenance and Repairs, p. 331; Roads to Be Constructed During 1914, p. 348; Road Grading in Counties, p. 352; Sidewalks in County Work, p. 355; Curb and Gutter on County Roads, p. 358; Drains for County Roads, p. 362; County Road Bridges, p. 369; County Road Signs, p. 373; Indiana Spends Fourteen Millions a Year on Roads, p. 384; Old Asphalt Pavements, p. 392; The Tractor for Heavy Hauling, p. 393; Government Supervision of Road Maintenance, p. 394; Revision of Manufacturers' Specifications for Brick Pavements, p. 394; Creosoted Yellow Pine Block Pavements in Dallas, Texas, p. 395; Large Road Contract in Greene County, Tenn., p. 403; Aztec Liquid Asphalt for Oiling Roads, p. 403; Smith Hot Mixer in Annapolis, p. 406.

May: Granite Block Pavements Recut to Small Size and Relaid, p. 426; Bituminous Road Construction, a Report of English Experience, p. 440; Laying Wood Paving in London, p. 446; Melting Point Tests of Bituminous Materials, p. 471; Concrete Road Construction in Indiana, p. 472; The Principles of Scientific Management as Applied to Highway Engineering, p. 474; Permanent Road Construction in the United States, p. 476; Prison Labor on Roads, p. 477; Motor Truck Service and the Public Roads, p. 485; Trinidad Asphalt for Maple Road, Indianapolis, p. 489; Aztec Asphalt, p. 492; Creosoted Wood Block Paving in Jersey City, p. 492; The M-C Paving Mixer, p. 494.

June: Reinforced Concrete Trestle in California Highway, p. 517; German Motor Trucks and Trailers, p. 528; Concrete Roads in Illinois, p. 534; Progress of the Asphalt Industry, p. 563; Modern Bituminous Surfaces and iBtuminous Pavements, p. 566; Good Roads a Factor in Real Estate Values, p. 569; Concrete Paving for Buhl, Minn., p. 569; Road Bee Day in Michigan, p. 574; Tractors on State Roads, p. 574; Asphalt Plant in Use on Road

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Work at the Ashokan Reservoir, p. 576; Loss of Time in Unloading Gravel, etc., Eliminated, p. 577; Some Modern Developments in the Asphalt Industry, p. 579; A Tractor with a Heavy Load, p. 580; Joint Protector for Concrete Pavements, p. 581.

In vol. xlvii:

July: The Bitulithic Pavement, p. 2; Who Supplies Novaculite, p. 47; Voids in Crushed Stone, p. 47; Burned Asphalt Cement Can Be Prevented, p. 49; Buckling of New Brick Pavement at Elmira, N. Y., p. 50; Empirical Requirements in Asphalt Specifications, p. 51; Variations from the Standard Asphalt Specifications, p. 53; Slab Tests of Brick Pavements, p. 54; Bituminous Concrete in the Roland Park, Guilford District, p. 56; Concrete Roads and Streets in the United States, p. 61; Better Roads Cut Living Cost, p. 62; Efficiency in Road Building Equipment, p. 69; Montreal's Portable Asphalt Paving Plant, p. 73; The South's Good Roads, p. 74; Hot Penetration Road Oiler, p. 75; Semi-Portable Bituminous Mixing Plant, p. 76; Condition of New Jersey Roads, p. 80.

August: Bitulithic on Macadam on Marlboro Street, Boston, Mass., p. 90; Good Roads as Crop Producers, p. 109; Economic Side of Good Roads Days, p. 120; Burned Asphalt Can Be Prevented, p. 125; The Perfection of the Modern Street Pavement, p. 148; Evolution of a Business Street, p. 150; The Cost of Good Roads, p. 151; A Ribbed Arch Highway Bridge, p. 152; Objects of the Indiana State Highway Commission, p. 153; The Passing of the Road Boss, p. 155; Reinforced Concrete Street Paving, p. 165.

September: The Municipal Asphalt Plant of Chicago, Ill., p. 184; Pavement Economy, p. 190; Expansion Joint in Alley, p. 214; Burned Asphalt Quite Unnecessary, p. 216; Buckling of New Brick Pavement at Elmira, N. Y., p. 221; Relation of Traffic and Cost of Maintenance of Roads, p. 225; An Unsupported Brick Highway in Continuous Use, p. 227; Asphalt Repairs in St. Paul, Minn., p. 229; European Rock Asphalts, p. 230; Fibered Asphalt Pavements, p. 234; Using the Motor Truck, p. 249.

October: Methods of Unloading Tank Cars, p. 256; Portable Asphalt Plant Resurfacing Macadam Road in Chicago, p. 305; Recent Granite Block Pavements in Philadelphia, p. 306; Increase in Use of Concrete Pavements, p. 308; Guide Post in England, p. 308; A Brick Road as a Monument; Good Roads Movement in Northern Illinois; Lighting the Lincoln Highway, p. 321; The Buffalo Brick Convention, p. 322; Bermudez Road Asphalt.

November: Recut Granite Block Paving in Bronx Boro, New York City, p. 344; Gas Leaks Under Bituminous Pavements, p. 351; Vitrified Brick Street Construction, p. 364; City and County Highway Drainage, p. 371; Motor Trucks for Market Delivery, p. 391; Repairs to Concrete Pavements, p. 393; Paving with Small Granite Blocks, p. 393; Cost of Supervision of Highway Construction, p. 395; The Filler for Brick Pavements, p. 399; Improvements in American Paving Practice Suggested by European Experience, p. 400; A Refrigerator Motor Truck for Dairy Products, p. 412; Wire-Cut-Lug Brick Has Phenomenal Popularity, p. 412.

December: Bituminous Macadam Roads in Rhode Island, p. 430; Motor Truck for Oiling Roadways, p. 442; Concrete Streets on Steep Grades in Mankato, Minn., p. 451; Rochester Can Specify Biutlithic, p. 455; New Municipal Asphalt Plant at Pittsburgh, Pa., p. 460; Increase in Asphalt Production, p. 463; Asphaltic Materials for Road Consrtuction, p. 464; Recut Granite Block Pavements, p. 467; Reinforced Concrete Pavement Foundation Over Trench, p. 471; The Development of the Road Paving Plant, p. 479; Clark's Traction Grader, p. 481; Street Signs and Sign Posts, p. 482; Steam Melting Asphalt Plant, p. 484.

Laying Vertical Fiber Brick Pavement

We have up for consideration now before our city officials a proposition of paving a street 30 feet wide, 3,900 feet long, with vertical fiber paving brick blocks. These are to be laid on old macadam base. At present the street has 9-inch crown but is very irregular. Curbs are in good condition.

I have never had any experience with this kind of paving material, and if consistent would like to have your opinion on the following questions:

Will vertical fiber vitrified brick blocks stand 18 per cent. test on 1911 rattler with 300 pounds cast iron foundry shot 1,800 revolutions per hour for one hour?

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The question is therefore one of the particular make of brick, as to material, method of manufacture, manner of burning, etc., and brick of either fashion may be subjected to the same tests and accepted or rejected under the same specifications.

The usual method of applying asphalt filler is to pour it hot into the joints from a can thru a spout so as to spread as little of the asphalt on the surface as possible. The amount of asphalt or other filler used will depend on the design of the lugs on the blocks and the closeness with which the bricks are laid to each other. One gallon per square yard is a rough estimate of the amount required.

The tendency with the modern kinds of traffic is toward flatter crowns so that the traffic will distribute itself better over the whole width of the pavement. A 9-inch crown causes the traffic to keep on the center line as much as possible. Perhaps the crown can be reduced somewhat if care is taken, in taking the inequalities out of the surface of the old macadam, to cut down such projections as appear in the crown of the old roadbed and fill such inequalities as appear near the gutter. The old macadam may be enough thicker in the center to permit cutting it off an inch or two, which may be all that is actually necessary to bring the crown down to 6 inches. Perhaps the gutters can be filled a little. However, the new surface of the street will be raised by 4½ inches, the thickness of brick and sand cushion, and it may be difficult to take care of the drainage with any more fill in the gutter. The difficulty in laying a brick surface on an old macadam base usually occurs at this point.

If the street is very nearly level, the crown may be 6 inches or even a little more for a 30-foot street, tho it would be better if less, but if it has a considerable slope longitudinally the crown should be still less.

Ordinances Regulating Street Excavations

I will appreciate it very much if you will have municipal street repair plants relay the street surface at the expense of the company. Can any of our readers cite ordinance or contract such as our correspondent desires?

Such regulations regarding connections made for plumbers with municipal pipe systems, whether water, gas or sewer, are in operation, but very few cities go farther than to require a plumber wishing to make such connections to make a deposit or file a bond to cover any expense which the city may incur in correcting his errors in making such connections and replacing pavements.

In MUNICIPAL ENGINEERING, vol. xlii, p. 185, will be found a rather new franchise for a gas company, which contains about the only form of requirement usually made, this one to the effect that "if said changes are not promptly made within a reasonable time after such notice, the city hereby reserves unto itself the right to remove all such conduits, appurtenances and apparatus from such streets, alleys or public grounds and collect the cost and expense thereof from said company. And if said company shall not promptly pay such costs or expenses on demand, the same shall be taken and held by the parties to be grounds for the revocation of the rights and privileges of said company on the streets, alleys and public grounds affected."

Specifications for Park Road

I would like specifications for a park road, 16 to 18 feet wide.

F. M. S., Peru, Ind.

Specifications have just been issued by the American Society of Municipal Improvements for gravel and macadam roads which are proper for park driveways. Waterbound macadam with or without bituminous surface treatment afterward and bituminous macadam by the penetration method are covered by these specifications, and choice should be made among them according to the amount of traffic the restrictions put on the kinds of traffic that may pass over the road and the money available for the work.

Six sets of specifications which have

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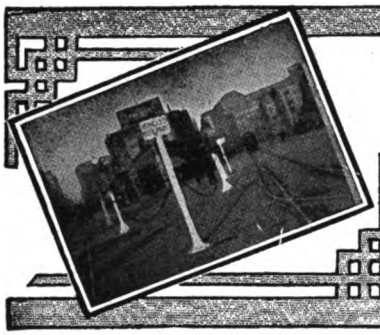

WORKERS IN THE FIELD

Houston, Texas, Has Co-operative Lighting Franchise

The Editor of MUNICIPAL ENGINEERING:

Sir—For years the Houston Lighting & Power Company, without competition, had been showing net earnings of about 20 per cent. on the successive yearly valuations. Total dividends of the company on the stock from 1906 to 1914 were $1,553,125.00, and the net value of the properties of the company on the last year was only $1,524,841.79. The service was fair to the consumer but the rates were admitted to be rather high.

In February, 1914, Mayor Ben Campbell, of the city of Houston (which is operated under the commission form of government), inaugurated the first step of an investigation into the affairs of the Houston Lighting & Power Company, with the avowed purpose of either bringing about a substantial and equitable reduction in the price of electric light and power for the people of Houston or building a municipal lighting plant for Houston. To this end, the city of Houston secured the services of Mr. Lamar Lyndon, consulting engineer, of New York City, who, assisted by a corps of experts, made a minute examination of both the physical and book properties of the lighting company, operating statistics, earnings and disbursements and the general output and equipment of the company. His comprehensive report, together with his recommendations for making the new rates, was submitted to the city of Houston. A copy was furnished the lighting company, who immediately employed an expert to go over the report and submit a counter-report. The difference in the valuation put on the properties of the company by the city's expert and the company's expert was aproximately $1,000,000 due largely to the fact that the company had taken no account of depreciation during the life of their plant. A fund was provided for depreciation by the company at one time, but subsequently passed to dividends.

The result of these reports was: (1) To present a financial history of the company; (2) To determine the proper valuation of the properties of the company, which should be used as a basis to determine the income which the company should receive in order to make a reasonable profit on its investment; (3) To show what the company received from all classes of service up to January 1, 1914, in order to pay all costs, depreciations and 8 per cent. profit on the proper capital charges existing over the period of years considered; (4) To show the various rates for electrical service which should obtain in Houston under the conditions of load, load factor, distribution and investment as obtain with the present equipment of the company, and compare them with the actual rates, and (5) To recommend equitable, just and fair rates for the future.

Pending the settlement of the lighting question, the city of Houston passed an ordinance which stated that any adjustment made between the company and the city of Houston, must apply and date from and after April 1, 1914, consequently, the rates just named will mean a substantial cash discount or refund to the citizens of Houston dated back from April 1, 1914.

During the progress of the light controversy, Mayor Campbell investigated every contract held by the company for power or light with wholesale customers. This inquiry resulted in ascertaining that thirty-two wholesale customers in the city of Houston were under "special contracts" with the company, by which contracts they received light and power at prices from 5 to 2½ cents per Kw. hr., while the other citizens were paying prices from 13 to 7 cents per Kw. hr. The company explained that they were "compelled" to make special contracts to prevent the wholesale customers from constructing their private generating plants.

After eight months' investigation, the following comprise the new light rates,

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which will save the citizens of Houston, Tex., approximately $200,000 each year, and explain their workings:

Lighting Rates: Nine cents primary per Kw. hr., and 5 cents per Kw. hr. for secondary consumption. All charges for lighting consumed for residential purposes each month shall be divided on the bill into primary and secondary charges, and the methods of determining primary and secondary energy shall be as follows: The unit for measuring the amount of energy to be charged for on primary basis shall be one-fortieth of the number of socket openings to each residence served, and the number of kilowatt hours charged for primary service shall be 30 times the unit thus attained; or, in other words, the primary basis shall be, as to each residence, the first 30 hours use in any monthly period of 50 per cent. of the connected load, the connected load being taken at 50 watts per socket opening in the premises served. All energy used by each residence in one month in excess of the energy thus charged as primary, shall be charged to the customer as secondary consumption at secondary rate. This formula shall be printed on the back of every bill rendered Houston customers.

Commercial Rates: To be the same as above, except as follows: The first 40 hours' use in any monthly period of the connected load of 50 watts per permanent socket opening in the premises served.

Power Rates: There shall be charged not more than the following rates: Five cents per Kw. hr. for primary and 2½ cents per Kw. hr. for secondary consumption. All energy for power service shall be divided into a primary and a secondary charge, and the energy that shall be paid for on primary rate shall be the number of kilowatt hours consumed which would be equal to 17 times the rated horsepower of the motors connected in the business served, and all energy consumed each month in excess of the energy charged as primary, shall be charged for at the secondary rate as secondary consumption. This formula shall also be printed on the back of every bill, for the benefit of the cus. 50 cents per horsepower per month, based on the motor rating.

Arc Lights: All series circuit outdoor city arc lights shall be installed complete for $57.50 connected with an overhead circuit; and $60 each when connected with underground circuit, per year, payable in monthly installments. These arc lights shall utilize not less than 6.6 amperes at approximately 80 volts per lamp. Where alternating arc lamps are used, the actual energy consumption in any lamp circuit must not be less than 425 watts per lamp, while in the case of magnetite lamps, the energy consumption must not be less than 350 watts per lamp. The company is required to use German "Electra" carbons or other carbons of equal merit in all alternating arc lights, and cored carbon in all lamps, and the light shall at all times be uniform and free from flickering, hissing or pumping.

Cooking Rates: Minimum bill, 50 cents per month. Energy for cooking to be metered separately at the rates of 5 cents for primary and 2½ cents for secondary. The unit of measuring the primary current shall be determined by the first six Kw. hr. of consumption each month for cooking and the balance of the energy consumed as secondary consumption.

Electric Fans: Where the entire load on the circuit is made up of fans, this load shall be rated as a motor load and shall take the same rates as for power service.

Representation on Directorate: The mayor of the city of Houston, under the light adjustment, was given the power to name two members of the board of directors of the Houston Lighting & Power Company, which members will own no stock, but will represent the city's interests on said directorate.

The Houston Lighting & Power Company is owned by the American Cities Company which, in turn, is controlled by the United Gas & Electric Company of New York, according to the findings of the investigators. That a settlement of so much importance also gave the city of Houston the right to participate equally in all earnings of the company above $160,000, or 8 per cent. on their

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Under the rates just made Houston has the lowest lighting and power rates in the South furnished by a private corporation.

PAUL H. SHELDON,
Houston, Tex.

Following are given the old and new rates in tabular form, so that comparison can be made readily:

OLD RATES

COMMERCIAL

Primary,	per Kw. hr.	$0.13
Secondary,	per Kw. hr.	.07

Subject to 5 per cent. discount.

POWER

Primary,	per Kw. hr.	$0.06
Secondary,	per Kw. hr.	.05

ARC LIGHTS

City,	per year.	$70.00
Commercial	per year.	90.00

NEW RATES

COMMERCIAL

Primary,	per Kw. hr.	$0.09
Secondary,	per Kw. hr.	.05

Subject to 10 per cent. discount.

POWER

Primary,	per Kw. hr.	$0.05
Secondary,	per Kw. hr.	.02½

ARC LIGHTS

City, for Underground connections.	$60.00
City, for Overhead services.	57.50

Commercial—The same as above.

Sewer Tunnel Construction in Alton, Ill.

The Editor of MUNICIPAL ENGINEERING:

Sir—A sanitary sewer district of 13½ miles of main sewer consisting of 8, 10, 12, 15 and 16-inch pipe and 4½ miles of 6-inch lateral connections built by Chas. E. VanWormer, of Springfield, Ill., contractor, has been completed and accepted by the Board of Local Improvements of Alton, Ill., and is now in successful operation.

In the construction of the system it was necessary to construct an outlet sewer two miles in length to the Mississippi River about 1,000 feet of which is in tunnel thru a hill 39 feet high, in which 12-inch cast iron pipe was laid at proper grade. The contractor in the construction of this tunnel deemed it a small job in itself and thought it not advisable to provide an expensive equipment for the construction of same. Such difficulties as arose during the construction had to be met with a rough equipment on hand.

The stakes were set every 50 feet on the center line and every 200 feet shafts were sunk to the proper grade. These shafts were made 4 by 8 feet and properly braced with oak timbers. The 8-foot side was parallel to the center line of the sewer. At each side of the shafts plumb-bobs were dropped and used to line up the tunnel driving.

Two shafts were worked at a time. Over each shaft was placed a swinging boom from which a wooden bucket was lowered and raised in the shaft with wire rope. Midway between the shafts an ordinary double-drum hoisting engine was placed. The wire rope from the buckets wound on these drums so that when one bucket was up the other bucket was down in the shaft. At the bottom of the shafts the heading was driven in both sides at the same time. The tunnel was made 6 feet high and 3 feet wide. The sides and top were sheated with 3-inch oak planking as the tunnel was driven. One man was at the heading, one man loaded the wheelbarrow and wheeled the muck to the shaft, where it was dumped into the buckets and raised to the surface and dumped. When a tunnel had been driven halfway to the next shaft, work from that end stopped, and the men went ahead to the next shaft. The heading men usually met very close to the center.

One difficulty experienced, was lack of ventilation. It was impossible to keep a light burning in the tunnel so that men could see or breathe after they had gone a few feet from the shaft. To overcome this an ordinary blower fan was secured and a 1½-h.p. gasoline engine was used to operate same. From the discharge end over the blower fan a 3-inch galvanized iron down-spouting was connected by means of tees, elbows and straight pipe down into the two shafts and thence each way into the headings. This fan furnished sufficient air so that all four headings could be worked continuously.

The booms above the shafts were also used for lowering the 12-inch cast-iron pipe. The pipes were lowered at the lower shaft and pulled ahead by cable tied to hoisting engine. When all the pipe had been lowered to extend from one shaft to the other and pipes were lined up and set to proper grade, spigot ends were driven home into the bell ends and yarned and calked with lead. The entire equipment was then moved to the next shaft, and the same process as above described was gone thru.

The entire 1,000 feet was driven in this way. Three shifts were steadily employed, each working 8 hours. The total cost of the improvement was $97,000.

The tunnel was driven and pipe laid in eight weeks. The work was carried on under the supervision of the writer as city engineer.

J. E. SCHWAAB,
City Engineer, Alton, Ill.

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The Training of the City Manager

The more efficient the government, the more efficient the employe.

Mr. Bryce, of the American Commonwealth, says: "There is no denying that the government of cities is the one conspicuous failure of the United States."

This statement should not be too discouraging. For years we ourselves have recognized the fact that we have been improving the conditions steadily.

In 1876 New York appointed a commission to devise a plan for the government of cities in the State of New York, and they suggested the following as the causes of the failure of the old forms of municipal government:

1. Incompetent and unfaithful boards and officers.
2. The introduction of state and national politics into municipal affairs.
3. The assumption by the legislature of the direct control of local affairs.

Sometime ago we began to realize that the city was a business corporation rather than an integral part of the state. In 1882, Brooklyn, New York, took a step toward concentrated power in connection with concentrated responsibility, by giving the mayor absolute appointive power without the confirmation of council of the principal executive heads of the departments.

Mr. Woodruff epigramatically states, "For policy we must select, for efficiency we must appoint."

This has been the difficult step to achieve: it means the breaking of the political hold on our political affairs, the loosening of the grasp of the professional politician, who stands for efficiency in his ward and precinct organization first, and efficiency in municipal affairs second. As Mr. Bryce so aptly states in criticising our municipal affairs, "There is a want of methods for fixing public responsibility on the governing persons and bodies."

We know from experience that the political appointee's first allegiance is to his political machine. This tradition has shackled general advance.

The city manager form of government is the application of business methods to the operation of a city.

The fundamental training of a city manager is the same as the training of any manager of large affairs.

He does not have to be an engineer.

In many American cities the engineering problems are the most important today.

Any good executive can be a good city manager.

Cities desiring city managers should elect the one whose previous training will best meet the requirements of every community.

If these statements are true, and we believe they are, how can city managers be best rtained?

A city manager should have at least a fair education, sufficient theory, but not too much to overbalance practicality.

He must be an executive.

He must know how to handle men.

He must be fair and just.

He must be firm but polite.

He must have the courage of his convictions.

Any man with these qualifications can be a city manager. Such a can can select subordinates and advisors to aid him in carrying out the functions of those departments with which he is not familiar in detail.

He as an executive must get efficiency from all his departments by organization.

This is what we have always attempted to accomplish in our old forms of municipal government.

We found, however, that we could not select them thru the ballot.

This is where the straight commission form of government is failing, as it attempts to select trained men for principal functions thru the ballot, and also attempts to combine the legislative and the administrative functions.

There is in communities a feeling against the employment of out-of-town men for city managers. This is usually the harping of the old faithful in the ranks of the political parties.

A perfect organization can usually be attained more quickly by selecting a manager from out of town, as he is not hampered by the local traditions.

I cannot lay too much stress on the importance of publicity. Under the old forms of government only such publicity was given as would best meet the ends of the particular parties in power.

The new forms of government must give to the citizens constructive publicity.

We must educate the people to the advantages which they are receiving from the new form of efficient government.

Under the old order of things, as soon as one party was elected into power, the public were immediately put thru a course of education as to why that party should be out of power.

The result has been that the notion is inbred for change.

As a result, every two years the citizenship becomes restless for change. This can only be overcome by education and constructive publicity.

H. M. WAITE,
City Manager, Dayton, O.

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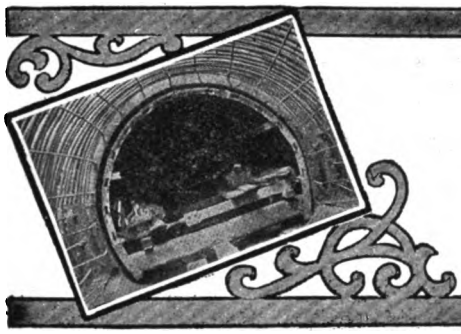

SANITATION

Pollution of the Des Plaines River by Chicago Suburbs

The Des Plaines river rises in Wisconsin a few miles north of the Illinois line and runs south parallel to the shore of Lake Michigan until it reaches the present location of the Chicago drainage canal when it turns toward the southwest and makes its way to the Illinois river. Above the drainage canal it receives very little drainage from the city of Chicago proper, but its watershed contained a population of 71,960 in 1910, of which one-third were inside the sanitary district. At present there are some eighteen or twenty sewers and drains of 15 to 18 inches diameter discharging into the stream and there is one sewage disposal plant in operation, that at LaGrange, a population of over 47,000 being served at least in part by these sewers. The central villages contain about 25,000 of this population, which would require a flow, for proper dilution of the sewage, of 85 cubic feet per second. This flow is attained on the average not much more than half the time and there may be 225 days in the year when the flow in this part of the Des Plaines river is less than 10 cubic feet a second. It is evident, therefore, that complaints of nuisance are well founded and will become more serious as the population increases.

A report by the engineers of the sanitary district shows that the flow of the river cannot be equalized to produce a satisfactory low water flow by means of reservoirs or otherwise and that pumping water from Lake Michigan for dilution would be too expensive.

Outfall sewers and sewage treatment plants are compared for each village and for the villages together and various plans are presented, contrasted and compared.

The problem is further complicated by the suit to prevent the use of more Lake Michigan water for diluting Chicago sewage in the drainage canal. If this suit is successful, all the sewage of the territory on the Des Plaines above the canal must be purified before it is discharged into the river. If it is not, at least part of the sewage can be brought down by intercepting sewers and discharged into the canal without treatment.

Meantime the report recommends the preparation of such plans as may be prepared in advance of the decision so that there will be no loss of time in beginning construction when the field is clear. The population of the area is requested to bear the ills it has with the best grace it can until the decision is made, as otherwise its expenditures may be on works which must afterwards be abandoned or changed at great unnecessary cost.

Sewer Explosion at East Boston Pumping Station

Associate Justice Charles J. Brown, of the East Boston District Court, has filed his report on the inquest on the explosion June 1 last at the pumping station of the Metropolitan Sewerage plant in East Boston with the clerk of the Superior Criminal Court.

The explosion resulted in the death of James Grourk, Philip Healey, Martin Devereaux, Cornelius Sullivan, Thomas M. Butler and Elmer Gifford, while others were injured. The inquest was conducted during July, and postponed until October, pending an investigation of conditions by experts.

Judge Brown's report on the death of James Grourk, which is similar to that of the others, is as follows:

"James Grourk died in consequence of burns and injuries received by him caused by an explosion of gasoline in the Metropolitan sewer at the pumping station located at Chelsea Creek, in East Boston. This pumping station is one of the largest in the Metropolitan system, and pumps the sewage which comes from all the cities and towns of the north Metropolitan line.

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"On the day of the accident the deceased, with other employes, was working in what is called the screen room at said station, installing a duplicate set of screens. There was a large amount of gasoline in the sewer, which vaporized and was ignited from some source unknown, causing a terrific explosion, which demolished the building and injured several people, of whom six died.

"This branch of the Metropolitan sewer covers a distance of 62½ miles, and has the sewage of many cities and towns flowing into it. There is a large number of garages in these cities and towns, which have connections with this sewer, as well as several de-greasing plants, laundries and other manufacturing establishments, which are constantly discharging gasoline, naphtha and benzine into this sewer, making it extremely dangerous and a menace to the public safety.

"I find there is a general laxity on the part of the local authorities in preventing this, and I recommend that the Metropolitan Water and Sewerage Board or the district police take the necessary action to remedy this evil.

"A most thoro investigation and examination by city and state engineers of the sewer and pumping station at different periods, as well as analyses made by city and state chemists of the effluent and air, proved conclusively that gasoline and other explosive substances are continually flowing thru the sewer, and I further recommend that all garages and other establishments using gasoline, naphtha and benzine in the several cities and towns which have connection into this sewer be compelled to instal separating traps, as is required under the regulations of the city of Boston.

"If this is done it will prevent almost entirely any gasoline, naphtha or other explosive substance getting into the sewer in the future."

The Metropolitan system that empties at East Boston is 62 miles long, and is the outlet for Arlington, Belmont, Charlestown, Cambridge, Chelsea, East Boston, Everett, Malden, Medford, Revere, Somerville, Stoneham, Wakefield, Winchester and Woburn.

Street Cleaning in New York

The department of street cleaning of New York city had an appropriation in 1913 of $8,403,205. This was to pay the expense of cleaning streets, removing ashes, rubbish, street sweepings and garbage to the dumping places, the removal of snow and ice and the sanding of the streets.

The city is divided into districts and each district into sections. In a paper by Frederick L. Stearns before the municipal engineers of the city of New York, the ninth district is taken as typical. This district is bounded by 58th and 89th streets, Central Park and the Hudson river, in charge of a district superintendent with a conveyance, and has four sections, each with section foreman with bicycle and an assistant foreman.

The district has 624,864 square yards of pavement and the daily average cost of cleaning the district is $238.52. The average number of sweepers is 64, each cleaning 9,654 square yards. The cost of hand sweeping is 38 cents per 1,000 square yards; $3.07 per cubic yard of sweepings. The average number of drivers used in the district is 60.

Hand Sweeping. The street sweeper, with his outfit, consisting of a can carrier, push cart, push broom, push scraper, etc., is assigned to a route. He goes over his route in the morning, picking up the litter, then goes over same, sweeping it. He puts the sweepings in a can on his can-carrier. When the can is full, he places it on the sidewalk near the curb. The cart driver collects these sweepings and takes them to the dump.

During the winter months, the sweeper wears a coat and cap, and thru the summer months a shirt with D. S. C. on it and a white helmet.

The sweepers meet at their respective section stations for roll call at 7.:45 a. m. and after 4 p. m. of each week day. In these section stations each sweeper has a locker for his clothes, etc., and there are storage rooms for the utensils. Previous to Col. Waring's time the sweepers met on the street corners and stored their brooms and shovels in such basements as they could get permission from the owner. The sweepers receive $780 a year and 25 cents an hour for Sunday work. There are 2,570 regular sweepers and 349 extra sweepers.

In the whole city the area of pavement to be cleaned is about 26,454,500 square yards. The average area for a sweeper to clean is 8,895 square yards.

Sweeping Machines. Revolving brooms sweep the street dirt into the gutter. By hand labor it is piled and shoveled into carts or put into cans by the street sweepers on the route. Nearly all of the 148 sweeping machines now in use were built by contract from plans and specifications prepared by Mr. Stearns.

The machines average in cost $185 each. New parts are kept in stock and the repairs are made by the department force.

The broom itself is made of thin hickory strips and does not revolve unless a clutch is thrown by the driver connecting the broom axle with the traction

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wheels. The sweeping machines are used where the sweeping is heaviest and are a great help to the hand-sweeping force. These machines cannot be used unless the street is first sprinkled to lay the dust. As the use of water is prohibited during the winter months, the machaines cannot be used during this part of the year. It costs 52 cents per 1,000 square yards to clean strets by this method.

The Merritt sweeping machine has three revolving brooms, one on each side of the machine, set at an angle so as to sweep the street dirt under the machine, and another set straight across at the rear which sweeps this dirt on to a conveyor. This dirt is conveyed to the top of the machine and discharged into cans on a platform in the front of the machine. These cans when full are placed upon the sidewalk near the curb and replaced by empty cans. The driver on the route empties these cans as he comes along making other collections. The city paid 41 cents per 1,000 square yards for the work done by this machine.

The Emerson vacuum cleaner has a broom that does the sweeping, a conveyor that carries the street dirt to a receptacle and a revolving fan that produces a current of air that carries the dust thru screens like the pneumatic carpet cleaner. The city paid 43 cents per 1,000 square yards for the work done by this machine.

Flushing. The most thoro method of cleaning streets is by the use of water in dry weather. The water washes the dust from the street surface and in moist weather it washes the slime away.

There are several methods in use for this purpose, the most common of which is washing the street with a hose attached to a hydrant. It is, however, expensive, wasteful of water and obstructs traffic. In a gang there are several sweepers with push brooms that sweep up and put in their can any material not washed into sewers. Hose flushing in the summer days is very welcome in the tenement district.

The cost of hose flushing per 1,000 square yards is 65 cents and requires an average of 1,969 gallons of water.

Another method of cleaning the street is by the use of flushing machines. There are two styles of such machines in use. In one there is an air and water tight tank. As the water enters the tank from the hydrant, it compresses the air in the tank, which is generally at about 5-lb. pressure before it is charged with water, until it is at the same pressure as the water in the hydrant. This compressed air forces the water on to the streets thru properly arranged nozzles. This arrangement is quite slow. Officials of the city came to watch these machines in operation and became impatient because most of the time the machine was either going to, coming from the hydrant or at the hydrant getting its charge of water. It has been found to be very saving in the quantity of water used and by going over the surface of the street a sufficient number of times, thoroly cleans any kind of pavement. Its slowness of work is, however, offset by its cheapness of operation. The pressure that forces the water onto the street is obtained from the pressure of the water supply, and any driver of ordinary intelligence can run the machine. It costs 39 cents to clean 1,000 square yards and uses 401 gallons of water. The city has tried several experimental machines of this type but at present owns only one.

Mr. Stearns designed a machine that had an air tank in one end of the large tank. There was a gasoline motor and air compressor on the front of the wagon. The air compressor was small and ran all the time, filling the air tank with compressed air. This compressed air was to be used as the pressure obtained from this hydrant became too low for effective work, thus keeping up the pressure until it was nearly all out of the tank. The valve to the air tank was then closed and the air compressor continued running all the time the machine was driving to the hydrant, charging, returning to the street to be flushed and until it was time to open the valve to connect the two cells of the tank. Air compressors are very heavy and this arrangement made a lighter machine and made use of all the pressure that could be obtained from the hydrant pressure and only acted as an auxiliary pressure supply.

Another machine was designed to work independent of the hydrant pressure. The tank was completely filled at the hydrant. The air compressor was large enough to pump all the air that was necessary to force the water to the street, as this required pressure. It was the most powerful and rapid apparatus that has ever been tried for street cleaning. In working for hours it only required three and one-half minutes to a block; this included all the time required for charging with water and traveling to and from the hydrant. This is some contrast to the previous machines that required 22½ minutes to a block. These blocks were running north and south on Madison avenue.

The other style consists of a water tank, gasoline engine, and a water pump. The tank is completely filled with water like an ordinary sprinkling wagon and the rotary pump forces the water onto the pavement at any desired pressure.

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It is easier to pump water than air to do the same amount of work, and the machinery is much lighter.

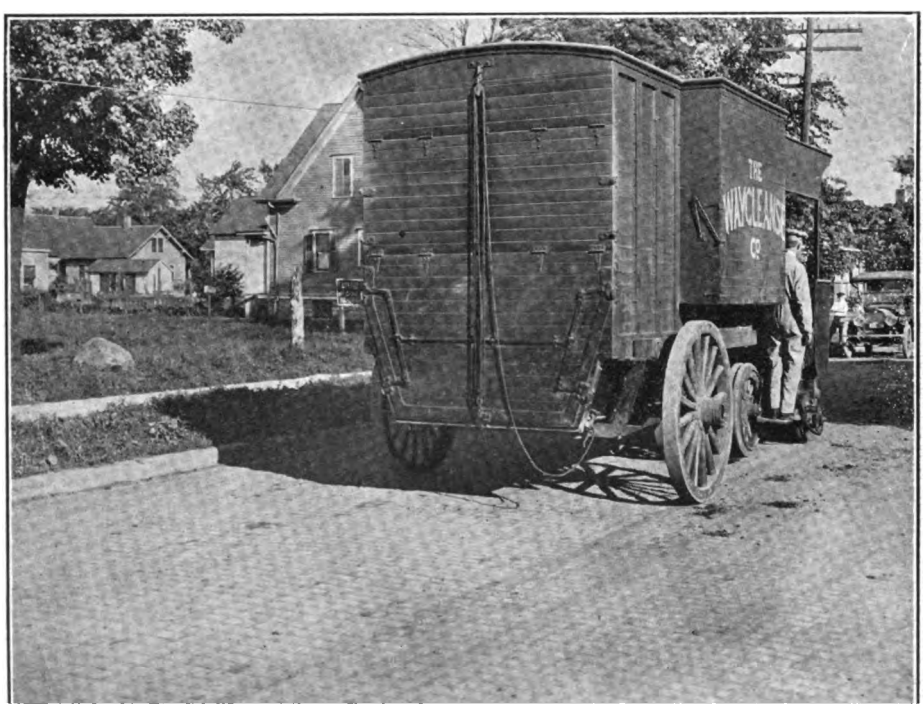
This machine works faster than the hydrant pressure machine, but a higher priced operator must be employed to run the engine. The cost of repairs are also higher and the cost of the gasoline must be added to the costs of operation. It is not dependent on the pressure of the water supply and is very satisfactory. Four of these machines are owned by the city.

Another method of washing the street is by the use of a squeegee machine. There is on this machine a water tank that sprinkles the pavement under the front wheels and a revolving rubber squeegee at the rear of the wagon. This is also quite a satisfactory machine for asphalt pavement that is in good condition. It is also very economical in the use of water and the revolving rubber squeegees the mud, dust and slime to the gutter, where it is picked up by the street sweepers. The city owns thirteen of these machines.

Experiments have been made with river water for flushing purposes, but there is a strong sentiment against its use because of its pollution with sewage.

By instruction of the former Commissioner Woodbury, Mr. Stearns exposed gelatine plates in different parts of the city and collected dust, particles and germs from the air before and after washing the street. It was found that the washing greatly reduced the germs. In one experiment the reduction was from 239 to 85 colonies. These plates were placed in an incubator at the Cornell Medical School,, and the germs allowed to grow until in the best conditions for photographing and examining under the microscope.

SHOWING *work done by a pneumatic broom sweeping machine on brick pavement.*



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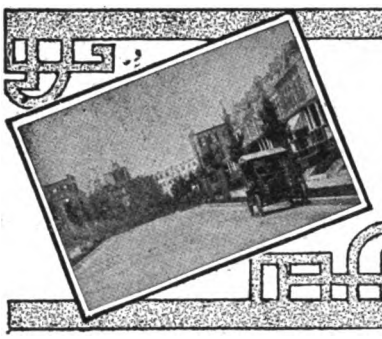

ROADS AND PAVEMENTS

Road Economics

The following selections have been made from the excellent paper before the Atlanta Road Congress by J. E. Pennybacker, chief of road economics of the U. S. Office of Public Roads:

1. All who share in the benefits of road improvement should share proportionately in the burdens.

The country road is no longer a mere local utility. Legislation should, therefore, provide for city taxation in aid of country road improvement. Automobile owners should individually pay a material portion of the cost of our public roads.

2. The degree of improvement should be proportionate to the traffic important to the road improved.

Too often have we seen costly improvements distributed according to the dictates of a few influential citizens or according to some arbitrary arrangement of political units or for sentimental reasons, or thru a cheerful, haphazard indifference. It is now generally believed that four-fifths of the traffic of this country is carried on one-fifth of the road mileage. It should be manifest that the most heavily traveled roads should first receive attention and should be improved in the most substantial manner. It is entirely feasible to make an expert study of a country road system and indicate graphically the traffic areas for each important road, so as to establish with reasonable exactness the amount of outlay which the traffic would justify.

3. The rate of payment or the rate of accumulation of the sinking fund on any public debt contracted for road improvement.

One faction either opposes debt in any degree, or contends for an indebtedness of such short term as to make it almost a cash transaction, and asserts that the road is entirely destroyed long before the debt becomes due. Another extreme faction contends for long-term indebtedness, on the theory that as posterity will reap the benefits it should bear the burdens, and that a road well maintained never wears out. As a matter of fact, location, if intelligently made, should be permanent; likewise all reduction of grades. The drainage features, if honestly and efficiently constructed, should be reasonably permanent. The road, except under extraordinary conditions, should, therefore, be considered reasonably permanent as to these features. As a general rule, the foundation of a road should not require renewal if the road is subjected to adequate and continuous maintenance. Avoiding any detailed consideration of the exact proportion of the total cost of a road represented by these features, I should say that in general the permanent features would average at least 50 per cent. of the total cost. So that, if the other 50 per cent. must be figured as perishable and subject to renewal, the debt should not cover a period longer than twice the length of this perishable portion.

4. Road building and maintenance comprise work requiring special qualifications on the part of those who direct it.

If the laws of the state would require that all persons selected to have immediate direction of road or bridge construction and maintenance possess practical knowledge and experience, and that this fitness be tested by some sort of competitive examination to be prescribed by a state highway department, acting either directly or thru a civil service commission, the net result would undoubtedly be the saving of many millions of dollars of road revenue and a wonderfully increased efficiency in our road system.

5. Responsibilities should be definite as to persons.

This proposition is aimed at the elimination of our present complex and cumbersome system of road management. If all of this antiquated organization could be swept aside and in its stead one or a few officials endowed with authority and charged with responsibility in each county, the beneficial effects could not fail to be most marked.

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6. Continuous employment is more conducive to efficient service than intermittent and temporary employment.

It is so self-evident that a minor defect in a road can be repaired at its inception with little effort, and that if allowed to go on it may require the entire reconstruction of the road surface, that it seems scarcely necessary to urge the soundness of this proposition.

7. The specialists who direct road work should be appointed instead of elected, and they should hold office during efficiency instead of for a fixed term.

The seventh proposition is designed to attract to the work men who look upon road-building as a life profession or occupation. If the right man is in the right place, it is absurd to limit him to a fixed term, for his position is not a reward. The county is purchasing his services and is supposed to get value received, and it should continue to purchase so long as he delivers the goods.

8. No road is wholly permanent but requires continuous upkeep, for which financial and supervisory provisions must be made.

A house is not permanent without repair, a railroad track is not permanent without repair, then why should public funds in a large amount be expended in road construction which, without adequate maintenance, may deteriorate to the extent of 50 per cent. in a few years?

9. Cash is a much more satisfactory form of tax than is labor.

If you provide an efficient highway engineer or county superintendent with a modest amount of cash and let him select competent,, efficient laborers, he can quadruple the effective results obtained by the same number of laborers under the old statute system.

10. All agencies at the disposal of the state, capable of use in works of public improvement, should be so used, rather than in such commercial production as would conflict with private enterprises.

The tenth proposition is directed partially toward the convict labor question, and is based upon the assumption that offenders against society owe a debt to society which should be paid in such form as will most benefit society, and the further assumption that honest labor should not be discriminated against thru the sale or disposal of products created by criminal labor. The practical application of this proposition would mean the employment of convicts in road-building, the preparation of road materials, or in other works of public improvement so far as practicable. This proposition is intended also to emphasize the necessity for correlation of the states' various agencies in the interest of road improvement. For example, a state geologist should be helpful in the selection and location of road materials, the laboratories of state universities should be useful in the testing of materials, the university staff should be helpful in the giving of theoretical instruction and in many cases in practical extension work, state bureaus of statistics and agriculture should be helpful in accumulating essential data for the road improvement work in the state, and state civil service commissions should be of very great use in the inauguration and conduct of the merit system in the filling of positions requiring technical or practical qualifications and experience.

Concrete For Paving

By G. W. Pickels, University of Illinois, Urbana, Ill., in Lincoln Courier.

Concrete was first used as a paving material in 1892 and from then till 1912 a total of 4,300,000 square yards was laid in the United States. In 1912 this type of pavement suddenly sprang into favor, and more concrete roads and pavements were constructed than had been constructed in the entire nineteen years preceding. Since then its use has steadily increased, and in 1913 over 8,000,000 square yards were laid, making a total of aproximately 18,500,000 square yards constructed up to January, 1914. For those who are not accustomed to thinking in square yards I will say that 18,500,000 square yards will pave 1,165 miles of 27-foot roadway. This yardage is distributed thru forty-two states, so it cannot be said that the use of concrete is local. It has been used principally in California, Illinois, Maryland, Michigan, Missouri, New York, Ohio, Washington, and Wisconsin.

The three principal types of concrete pavements are (1) the one-course, (2) the two-course, and (3) the bituminous top. Other types which have been used to a lesser extent are Hassam, Blome, Dolarway, etc.

The one-course concrete pavement as its name implies, is laid in one operation. The thickness depends upon the character of the subgrade, the drainage, the traffic, the width of pavement, etc., and varies from 6 to 10 inches. There is probably no other structure composed of concrete that requires as dense and as hard a concrete as does a concrete pavement. To secure this result care must be taken in selecting the sand and stone aggregate, and tests must be made both before and during construction to ascertain the proportions of cement, sand, and stone that must be used to obtain the

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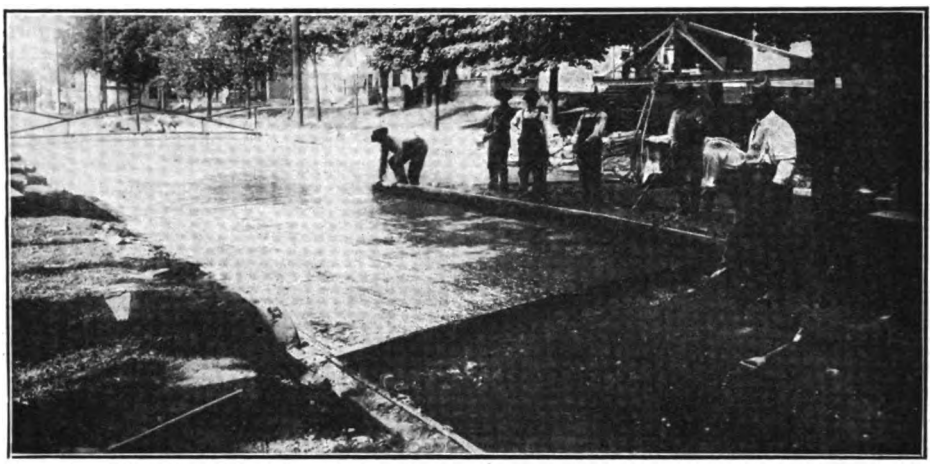

FINISHING SURFACE *of Concrete Pavement with wooden floats operated from traveling bridge spanning the pavement.*

densest and strongest concrete. A concrete pavement constructed on the assumption that concrete is concrete and that no more care is necessary in its construction than is requlred in a concrete sidewalk for example, is almost certain to be a failure. According to the best practice "the fine aggregate should consist of sand, crushed stone, or gravel screenings, graded from fine to coarse and passing when dry a screen of ¼-inch mesh. The coarse aggregate should consist of clean, hard, and durable gravel or crushed stone graded in size, all of which will pass a 1¼-inch screen and be retained on a ¼-inch screen.

The mixing and the placing of the concrete are as important as the selection and proportioning of the materials. The materials must be thoroly and uniformly mixed and especial care must be taken to see that they stay uniformly mixed and that the stone and mortar are not segregated after the concrete comes from the mixer. An uneven distribution of the material will take place if the mixture is too wet. One of the most common defects that is noticed in the surface of concrete pavements is the non-uniformity of the mixture, which results in a rough and uneven surface.

Longitudinal expansion joints are placed along each curb, and transverse joints are usually placed from 25 to 50 feet apart. The transverse joints should be protected from excessive abrasion and spalling by two strips of metal, 3 inches wide and 3/16 of an inch thick, having a high abrasion resistance, between which is placed the joint filler, consisting of a prepared felt about ¼-inch thickness and of a width equal to the depth of the pavement.

The concrete is brought to a uniform surface by means of a template resting on the curbs. It is then finished with a wooden float from a bridge spanning the pavement. To prevent the concrete from drying out too rapidly it should be covered with canvas until it has set, and then covered with sand or earth to a depth of about 2 inches, after which it is kept sprinkled for at least two weeks. If possible the pavement should be closed to traffic for a month after it is completed.

Pavements over 20 feet in width are generally reinforced with a triangular-meshed woven wire fabric, placed from 2 to 3 inches below the surface. The purpose of this reinforcement is "to distribute the effect of expansion and contraction due to temperature and the moisture content of the concrete."

The two-course pavement differs from the one-course in that it is not of the same composition for the entire depth and that it is laid in two operations. The first course is called the foundation course or base and is similar to the concrete base used for brick, asphalt, and wood-block pavements. It is generally about two-thirds of the thickness of the entire pavement and is composed of a much leaner concrete than is used in the one-course construction. The second or wearing course is usually composed of two parts of the fine aggregate, such as is used in the one-course pavement, and three parts of clean, hard, and durable crushed rock or gravel passing a ½-inch screen and retained on a ¼-inch screen. This course should be as dense and strong as possible to make it,

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and should be laid before the bottom course has set. The function of the top course is to resist crushing and abrasion, and to do this it must be composed of a mass of hard stone firmly held together by a cement mortar.

The failure of concrete pavements of the above type to resist abrasion due to impact has led to the development of the bituminous top concrete pavement, which is nothing more than a pavement of the first or second type—generally of the first—with a thin covering of some bituminous substance which acts as a cushion and to some extent absorbs the shocks of travel. The difficulty that has been experienced with this type is in getting the bituminous covering to stick to the concrete, and because of this its use has been discontinued in some localities.

Approximately 20 per cent of the concrete pavements constructed to date are of the two-course type, and 80 per cent. are of the one-course type. Of the 80 per cent. of the one-course construction about one-half has been covered with a bituminous top.

There are five important factors governing the success of a concrete pavement: (1) Good material, (2) proper proportioning, (3) mixing, (4) placing, and (5) curing. Much stress is usually laid upon the first two items and not enough upon the last three. In fact, a pavement constructed of average materials, proportioned according to some standard ratio, but not tested for density and properly mixed, placed and cured, will usually give better satisfaction than one in which the materials are excellent in quality and correctly proportioned but carelessly mixed, placed and cured.

Concrete pavements are affected very little by rubber-tired vehicles even of the heavier class, but the impact and abrasion of horses' hoofs and of steel-tired vehicles causes considerable wear. If the pavement has been constructed properly so that the surface wears uniformly, no great harm is done; but if improperly constructed, the surface will become rough and uneven and full of depressions.

There can be no question but that the concrete pavement is a valuable type and that its use is certain to increase rapidly. However, judging by our present knowledge and experience, concrete pavements are suitable on streets of moderate travel only. Streets carrying motor traffic or light horse-drawn traffic that in the past have been paved with brick will in all probability in the future be paved with concrete. In comparing concrete with brick, asphalt, wood block, etc., it must be remembered that it is consideraly cheaper, being approximately 25 per cent. cheaper than brick, which is its nearest rival.

FINISHED CONCRETE ROAD *surface in Wayne County, Michigan; photographed by Universal Portland Cement Co.*

Concrete Paving Design

From an article by W. D. P. Warren in Engineering and Contracting.

The purpose of this article is to call attention to the great necessity for the design of concrete pavements.

Engineers have written numerous articles during the past few years concerning concrete pavements, laying stress on the importance of workmanship and materials, and in their endeavor to secure the best results by better workmanship and materials, they have almost ignored the more important item of design. Concrete is subject to certain laws and its behavior has often been demonstrated, both in bridge and building construction.

What are these stresses which cause defects in concrete pavements? Where are they applied? How great are they?

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How may they be overcome? These questions may be briefly answered as follows:

Experience has demonstrated that expansion and contraction will cause transverse cracks in a pavement slab 6 inches thick, if the transverse joints are placed 50 feet apart, and that 25 or 30 feet is a safe distance to space them. Joints so spaced and protected by metal plates will free such a slab from any danger of transverse cracks due to contraction and expansion.

Other important stresses tending to produce cracks have been found to act vertically. Vertical motion is produced by the movement of the foundation upon absorbing moisture and again upon drying out. It is produced by the settlement of the sides of the roadbed, where they are less compact than the center. This vertical movement is sufficient to cause the slab to act as a beam.

Hundreds of miles of concrete sidewalk and concrete pavement blocks have cracked longitudinally. They all show failure along the center, or, in cases of extreme width, probably 10 feet out from the gutter line. This teaches but one thing, they were caused by forces acting vertically.

If a concrete sidewalk 4 feet long, 4 feet wide, and 4 inches thick does not crack longitudinally, and yet a block 4 feet long, 8 feet wide and 4 inches thick does crack longitudinally, what is the reason? If a thousand of such blocks crack longitudinally, what is the reason? It is not temperature, stress, contraction, expansion, unknown factor, dished or crowned sub-base, lack of reinforcement, but simply lack of strength in the slab to withstand the vertical movements of the foundation. In other words, for every width of slab, a definite thickness is required. This law is absolutely universal and every longitudinal crack in Wayne county, Michigan, Iowa, Illinois, or any other place, could have been prevented had the slabs been correctly designed.

We know the force of the vertical movements, for if they have caused uniform failures, and if failures have been prevented by a uniform reduction in width of slab to meet the thickness, we know all the necessary facts required to design correctly such a slab to withstand such vertical movements.

One reason why engineers have devoted so little time to concrete pavement design is that pavements have been a gradual growth from sidewalks and private driveways and few people have realized that a concrete slab for such purposes requires a design. Another reason is that the cement and steel people have designed either directly or indirectly many of the pavements and year after year they have proceeded with utter disregard of engineering principles.

The writer attended the National Conference on Concrete Roads, held last February in Chicago, and was in touch with many of the engineers there. It was observed that few came out with a frank admission of failure in design, and yet were more than anxious to learn a means of building concrete pavements without cracks, when it was intimated that such a thing was possible.

In MUNICIPAL ENGINEERING for July, 1913, The Morse-Warren Engineering Company, of Carlinville, Ill., discussed the mathematics of concrete pavement design at some length, and later a table was prepared showing the thickness required for certain widths. During the past year, the correctness of design outlined therein has been demonstrated to numerous engineers. While it is true that in rare instances a pavement may be built on a porous foundation which will not be subject to vertical movements, it is poor economy to build any concrete pavement which is not designed to meet general conditions.

There are a few principles of design which, if followed, will produce at an economical cost, a concrete pavement free from cracks. They may be briefly outlined as follows:

1. Transverse and longitudinal cracks are caused by stresses which are greater than the strength of the concrete.

In other words, a slab of concrete, say 4 feet square and 6 inches thick, could withstand the forces of expansion and contraction and the vertical movements of the foundation, even tho they should raise it several inches. It could stand the shock of travel and the action of the elements; in fact, such a slab would be free from defects.

That the economical slab is much greater in size than one 4 feet square has been demonstrated, and that there is a definite economical size of slab will be more fully explained in this article.

2. Vertical movements in the foundation cannot be economically prevented by additional rolling of the sub-grade nor by drainage.

This principle will be more fully understood when it is known that some of the strongest efforts to reduce cracking by putting the sub-grade in a permanent, immovable, and absolutely stable condition, free from moisture, and free from any tendency toward future settlement, have failed entirely.

Take for instance the sub-grade at the edge of a pavement with a 6-inch tile laid 4 feet deep under that edge. In our section of the country, today, the entire sub-grade is dry. But suppose we have a season of rainy weather, with water

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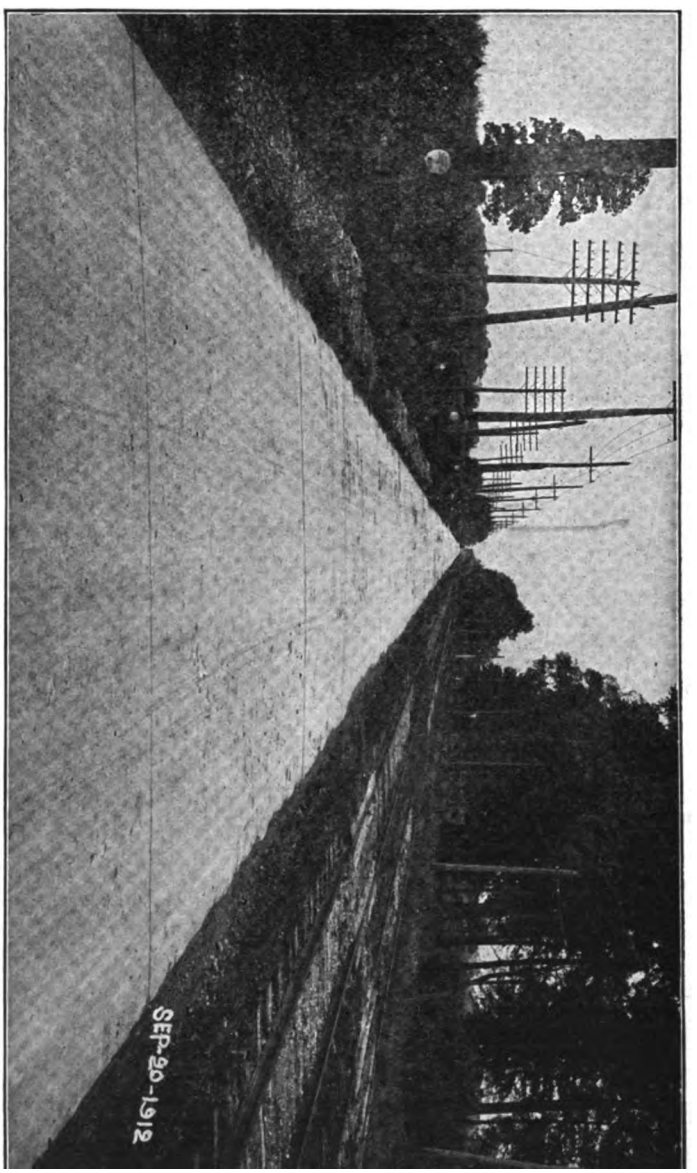

FINISHED CONCRETE PAVEMENT *with transverse joints protected by anchored plates on the system of the Trussed Concrete Steel Co.*

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covering the ground in many places. The 6-inch tile will act promptly and proceed to carry off the water, but at the same time the earth at the sides of the pavement will have absorbed moisture, causing it to swell, and the earth under the center of the pavement absorbing less, will swell less, thereby causing unequal movement in the foundation and cracks in the pavement slab. This force acts in the opposite direction when the earth becomes drained at the sides more quickly than at the center. The writer has observed slabs of concrete absolutely supported by a longitudinal ridge of earth, with the edges of the slab extended out into space, so to speak, and acting as a cantilever.

3. Reinforcement is a deception, as geenrally recommended.

Several scientific articles have been published during the last year, calling attention to the fact that any sufficient amount of reinforcement to prevent cracks in concrete pavements is prohibitive in cost; also it has been shown that the per cent. of reinforcement now generally recommended and used is only about one-tenth that ordinarily required.

Many engineers have built reinforced pavements after having had failures in plain concrete pavement construction, and have not taken into consideration the fact that they are getting better results in their later work, not because of reinforcement, but because of better workmanship and material.

A representative of one of the large steel industries after having inspected many miles of pavements, recently informed the writer that he had at last given up the theory that concrete pavements were to be saved from cracking by the use of reinforcement.

The vertical forces tending to destroy a concrete pavement act both upward and downward and yet some material men have the boldness to advertise that a reinforcement placed 2 inches below the top of a pavement will absolutely prevent cracks. If necessary 2 inches below the top it is equally necessary 2 inches above the bottom but the point to be made here is that all such so-called reinforcement is not reinforcement at all; never was figured to be; and never can be anything but an extravagance and a deception.

4. For a given thickness of slab, with good workmanship and material, a definite width is required. The limit of width for a 6-inch slab, 1:1½:3 mix, is 10 to 12 feet, and everywhere you will find concrete pavements with longitudinal cracks where the width is any greater with that thickness.

5. It is economical to make a longitudinal joint in a pavement slab rather than increase the thickness where the width is increased.

If 6 inches is ample to give strength and durability sufficient for travel, it is poor economy to make the pavement any thicker simply to have a continuous beam or slab across the roadway.

Such a longitudinal joint should be protected by a metal plate now manufactured for that purpose. There is no patent on this plate.

6. A joint in a concrete pavement, properly protected and covered by a metal plate is not a weakness.

Engineers have in recent years thrown up their hands in horror at the idea of a joint down the center of a concrete pavement. The fact is that today thousands of taxpayers are throwing up their hands in "holy horror" at the joints in their pavements, joints not planned and not protected by metal plates, which are unsightly, damaging and irregular, and each year increasing the expense of maintenance. As suggested a year ago in one of our leading engineering magazines, longitudinal joints are not to be avoided; they are an absolute structural necessity.

7. A factor of safety should be allowed in design.

The methods of design herein outlined will produce a concrete pavement free from cracks, a pavement costing much less per mile than now recommended by engineers, and a pavement which contractors will with safety guarantee against cracking for a five-year period.

It is the belief of the writer that the design of concrete pavements and the proper protection of a longitudinal joint down the center of the pavement should now receive the attention of the more expert, and that present knowledge of construction should be classified, with the thought in mind that concrete pavement design be reduced to a science.

To those who see the possibilities of the future, and to those who believe that there are defects today in the design of concrete pavements, is submitted the proposition: To design or not to design.

Increase in Highway Construction in 1914

That remarkable progress has been made in the building of good roads thruout the United States during the past few years is proven by data recently obtained by the American Highway Association and soon to be published in the official Good Road Year Book for 1915. It has been found that more than 34,000 miles of surfaced roads have been constructed during 1913 and 1914 and that during the ten-year period from 1904 to

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1914 more than 96,000 miles have been completed. That this progress has been really amazing may be understood from the fact that in 1904 there were only 153,000 miles of surfaced roads of all types in the United States. That the movement is attaining momentum as it goes is proven by the fact that while the average mileage construction per annum during the past ten years is 9,600 miles, the total completed for 1914 exceeded 18,000 miles. The report will show that something like 30,000 miles of highway have been completed with the aid of state funds, of which over $200,000,000 have been expended. The state aid movement began in 1892 and has therefore continued for twenty-two years. Only recently has it gotten well under way, as the results accomplished for 1913 and 1914 comprise a total of 10,000 miles of state aid highways completed, or in two years' time one-third of the entire mileage constructed with the aid of state funds has been completed.

Only six states now, out of a total of forty-eight, are without state highway departments and thirty states have granted actual money aid to the building of roads. The year book, which is the official reference publication for all good roads information, is a large cloth-bound volume issued early in each calendar year by the American Highway Association.

Simplified System of Town Highway Accounts

By Fred Buck, Assistant Deputy Commissioner, New York State Highway Department, before the Atlanta Road Congress.

The funds for town highway work in New York state are derived from two sources: First, a tax levied by local officials upon the several towns, this tax being supplemented by moneys paid by the state to the towns for the same purpose, which moneys are known as "State aid," the amount payable to each town being dependent upon the assessed valuation per mile of highways of the town and the amount raised by the town as the highway tax in each year. These moneys combined form what is known as the highway fund.

In the prosecution of the work the town superintendent of highways is the man in charge. He hires the men and teams, purchases materials, directs the work and acts as paymaster; the paying, however, being done by means of vouchers issued by himself as town superintendent, the vouchers being redeemed in cash by the supervisor (who is the chief fiscal officer of the town) and retained by him as a receipt for money paid until the close of the fiscal year, when, upon rendition of his annual report and its acceptance by the town board, these vouchers are filed with the town clerk and become a part of the permanent records of the town. These vouchers, which are furnished to all towns by the state highway department, consist of a printed form with the necessary blank space for the insertion of the date, the name of the payee, the dates on which service was rendered, the number of hours of service or quantity of material, as the case may be, and the road for which it was furnished. Each voucher is attached to a stub upon which are blank spaces similar to those of the voucher.

The supervisor is provided with a supervisor's account book, printed and ruled to receive an entry of each voucher paid, spaces being provided for data relative to the voucher corresponding to that in the body of the voucher itself. Pages are provided at regular intervals for a recapitulated statement of vouchers paid, the data upon these recapitulated pages being finally carried forward to a single page thereon condensed into a form of statement, which is the annual report of receipts and disbursements required of each town supervisor under the highway law. Blank forms are provided for such additional copies of this report as are required to be furnished to the county superintendent of highways, the state highway commission, and the state comptroller.

No other books or accounts are necessary for the town superintendent of highways or the supervisor in properly receiving, disbursing and accounting for the highway moneys of any town than those which have just been described.

With practically no exceptions the town officials are pleased with the form of accounting, and errors and mistakes have been reduced to a minimum so small as to be almost a negligible quantity.

Partial audits of the highway accounts of any town are made by a representative of the state highway department at any time during the year when for any reason it shall be deemed that the same is necessary or expedient. By doing this many errors are prevented which might otherwise occur and unwise or extravagant expenditures are prevented, or checked if begun.

Each year a complete audit of the highway accounts of each town in the state is also made, and it is found that the form of voucher and manner of accounting for the same provided for the supervisor greatly simplify and facilitate the work of the auditor.

January, 1915.

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It is pleasing to be able to state that, while the audits of the first year in which this system was put in operation showed a large amount of errors and discrepancies (due, mainly, to unfamiliarity with the system or to carelessness in making entries) the audits of the years since the first show a constantly decreasing number of inaccuracies. It is also pleasing to be able to state that extremely few instances of actual dishonesty have ever been uncovered and that in very nearly all cases in which reimbursement has been required the occasion for the same was due to ignorance or carelessness and not to actual dishonesty on the part of any town official.

Those who have been most closely associated with the work are also firm in the belief that the quality of the town highway work of the state as a whole and the very excellent results secured have been contributed to in no small degree by the simplified system of town highway accounting which has been used in connection with the work.

Road Maintenance in Minnesota

In a paper before the Atlanta road congress Geo. W. Cooley, state highway engineer of Minnesota, gives the following as the practice in that state:

The state of Minnesota has given special attention to the matter of maintenance and the present road laws make adequate provision for the care of all roads. Township and county roads constitute approximately 90 per cent. of the road mileage of the state, and of these roads, about 90 per cent. are earth roads. To care for the town and county roads, a one mill tax is levied on all property in the town, the proceeds of which constitutes the town dragging fund. This fund is expended under the direction of an overseer, appointed by the town board, for the purchase of drags, and in dragging all roads of the town, excepting state roads. This appears to be the most satisfactory method of caring for the earth roads under control of the local authorities, but there should be a provision in such cases, for general supervision of the work by the county highway engineer.

For the care of state roads in Minnesota, 20 per cent. of the state road funds, with a due proportion of county funds, are set aside and may not be used for any other purpose than maintenance of state roads. As the state roads include all types of construction, different systems of maintenance have been required in the different localities. In general, three systems have been established: The patrol system on macadam and well built gravel roads, and the maintenance section system, and road drag system on other roads, all being under the direct supervision of the district highway engineer.

Under the patrol system, one man is assigned a section of from 5 to 7 miles of road and works with hand tools. It has been found necessary to supplement this work with the occasional use of a team and in that manner it has proven satisfactory on macadam and gravel roads.

Under the maintenance section system, one man is given charge of a section of from 20 to 30 miles of road and is employed continuously with his team on the care of his section. He is given authority to employ additional help, both teams and men, and usually has two teams and four or five men at work. Contracts are also entered into by the section foreman with residents along the road, for the dragging of same after each rain, or when ordered to do so by him. The section crew takes care of all minor items of construction, such as placing culverts, etc., and we have found that the work when properly done, is really of a constructive nature. This system is without doubt the most effective, and is being adopted generally thruout the state.

The dragging system requires the employment of a superintendent of maintenance, who for convenience should be one of the engineer's assistants, whose duty is to contract or make arrangements for the dragging of all roads under his charge, and to see that the work is done at proper times. This system is suitable for slightly undulating prairie country, where most of the roads are of earth, and to get best results the superintendent should have at his disposal light graders to reshape the road bed at least at the beginning of each season.

On earth or gravel roads, no maintenance system is complete which does not contemplate the use of planers or similar devices, and a combination of work as outlined under the section system is recommended.

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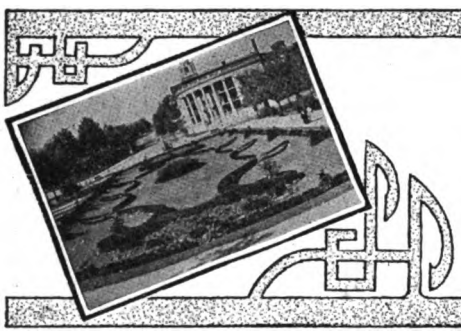

CIVIC BEAUTY

City Planning and A Topographical Map

From a Paper by Mayor Joseph W. Shirley, Topographical Survey Commissioner of Baltimore, Md., before the Engineers and Architects Club of Louisville, Kentucky.

It does seem odd that the separate elements embraced within city planning, such as buildings, railroads, municipal works of all character, are each studied and planned seriously and altogether scientifically. Yet, to the composite whole, there is the minimum of attention. In other words, the smaller things receive our most minute care and the largest thing that man has yet built, a city, is allowed to progress in the most haphazard and care-free way possible.

Out of the number of good recommendations which I read in the report of the Louisville City Improvement Commission, there are two which fall, especially, under the topic on which I am speaking. One is that you must have a good survey and map on which to base any plans for improvement, and afterwards you must endeavor to develop a sensible city plan. Your committee asks for $30,000 for the preparation of this map, hardly a sufficient sum. In Baltimore we made an excellent survey and a map on the scale of 200 feet to one inch with contour intervals of 5 feet, in square mile sections, 38 of them. It shows all essential details for the development of new areas as well as for the rearrangement of the older sections. A complete triangulation of the city based on the general method used by the U. S. Coast and with the sole idea of preparing for a civic center. Your committee's report grasps the true essence of city planning by considering the necessity for planning for the undeveloped sections of your city. This is something you can now do while you are, at the same time, giving study to conditions needing rectifying in your built up and congested sections. If you do not give proper attention to your growing sections you will very soon find that territory in as bad conditions as are the older portions of your city which were allowed to develop without care or attention. It is a relief to note that the report did not limit itself to the mere rearrangement of governmental and municipal buildings about a central neighborhood. I do not, however, mean to despise any proposal for the grouping of such buildings. There is an extremely worthy motive back of any such movement and one in which you will find you can arouse the greatest interest among the public generally. But to feel that city planning has this for its one and only object is a most serious mistake.

Just before our Baltimore map was made we had annexed a considerable area to the city, about 31.94 square miles. Previous to the time of annexation this territory had been studied according to the old fashioned lights regarding the system of proposed streets, and the streets were for the most part marked by granite monuments at the northeast corners. The lines conformed to the old checker board or gridiron ideas. Fortunately, however, we had a number of good routes of travel leading from the heart of the town to the outlying sec-

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ment of our suburban sections. The old plan, viewed from the light of modern practices, was far from ideal and it has been amended and changed so often that its originators would now hardly know their work. I think, at one time, a great many of those having to do with the expansion of the street system in our larger cities felt that they could lay down a definite plan, adhere to it rigidly and, by some as yet unexplainable method, enforce the street plan development on all property owners. Our experience in Baltimore has been that this was indeed a fanciful dream. We have not done it, tho on the whole, I think we have succeeded very well in carrying out the more important elements of the plan. We rely principally on a law which states that the city cannot condemn and open a street nor accept the deed or dedication of any street the lines and grades of which do not conform to the established street plan. In other words, we can not absolutely prevent property owners from laying out their streets along non-conforming lines, but we can and do refuse to grade, pave, lay water mains and sewers or provide lighting in the beds of such streets as are incongruous to the plan, and this, in itself, has had a marked stimulus in limiting haphazard lay-outs.

But in by far the larger area under control of the Topographical Survey Commission the street plan is developed thru a compromise between the city and the property owners. This is, of course, not ideal and no doubt the future will give us more stringent means of developing the street system in conformity with the ideas of the city and not along the lines best suited to the individual property owners.

¶WIDE, DIRECT THOROFARES *between sections of the city the main object of the Baltimore commission.*

Our main object, however, in the supervision of the street plan, has been to provide for wide, direct thorofares from one section to another and from all sections to the heart of the city. I think we have been fairly successful in this endeavor. We have felt that this is de-

electricity, motor busses, or even air craft, we must have streets, and it seems only proper that the location, widths, extent and all governing features should be considered by men capable of making suggestions founded on proper and scientific study. In other words, let us, at least, try to develop our growing street system as well as we can.

At the same time, let us give study to the rearrangement of our congested and badly arranged internal development. These are the two main factors in city planning.

After the disastrous fire of 1904, Baltimore had an excellent opportunity to hew right and left along the lines affording better street facilities in the congested portion of the city. Those who have had anything whatever to do with any phase of city planning will know how extremely difficult it is to obtain even the smallest improvements. We did some things well and we also left undone some things which we should have done. On the whole, however, I think we can justly feel proud of the results.

The area destroyed in the Baltimore fire was 140 acres. After the improvements, including street widenings and extensions, were completed it was found that more than ten acres in excess of the old streets were used. In the heart of the most valuable property of the city this was quite an item. There were two other important improvements, new municipal docks and markets, which together took out nearly twenty-eight acres more of private property. The total cost of all the improvements in the burnt district was a little over seven and one-quarter millions of dollars. The benefits assessed in the nearby zone were about one and one-eighth millions of dollars, making a net cost to the city of a little over $6,100,000.

Before the fire there were 1,343 buildings which were assessed at a total of nearly thirteen millions of dollars. There are now less than eight hundred buildings, assessed at about twenty-five millions of dollars. So, it can be seen, that altho we wiped out about thirty-eight acres of valuable commercial property at a net cost of over six millions of dollars, we have at the same time practically doubled the value of the improve-

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example in arithmetic will show that it will not be very long before the increase in taxes in the district will not only wipe our slate clean, but will give us a good revenue besides."

This is in contrast with the result in San Francisco outlined in the following extract from a paper on the water supply of the San Francisco-Oakland metropolitan district in the September proceedings of the American Society of Civil Engineers, by H. T. Cory, M. Am. Soc. C. E.

"The topography and natural features of San Francisco are such that it could have been made one of the most beautiful cities in the world. Unfortunately, like many other places, it grew 'topsy fashion,' and the layout is rectangular, quite regardless of the configuration of the land. There result grades as high as 22 per cent. The opportunity which the great fire of 1906 presented for redesigning the most important part of the city was not utilized. The city engineer's office recently stated that $26,000,000 was the cost of certain improvements, necessary under the circumstances, but which would have been entirely avoided had the city's planning been adjusted to the topography, as might have been done, and that this expenditure was but the beginning of a series which from time to time must be made."

¶LARGE PLANS *are the only ones which have any chance of success and are the only ones worth while.*

In any campaign for the development of your city along proper lines you will encounter the sometimes embarrassing query as to the net cost and the benefit, if any, from a purely monetary point of view.

Mr. Daniel H. Burnham, the famous designer of the World's Columbian Exposition at Chicago, once said:

"Make no little plans; they have no magic to stir men's blood and probably themselves will not be realized. Make big plans; aim high in hope and work, remembering that a noble, logical diagram once recorded will never die but long after we have gone will be a living thing, asserting itself with ever-growing insistency. Remember that our sons and grandsons are going to do things that will stagger us. Let your watchword be order and your beacon be beauty."

It is hard, however, to convince many citizens that the improvement which you may be considering falls within the category mentioned by Mr. Burnham, and you will often be required to give some kind of estimate of the cost. In a great many cases in city planning this is well nigh impossible and you must have recourse to similar undertakings in other cities. Good city planning has not been applied for a very long time to many American cities and you may be often hard put to it to find a proper analogy. It is, however, often surprising, when the attempt is made to seek such information, to discover excellent suitable examples. For instance, I have just given you the result of a series of street widenings and extensions within a goodly area of the congested and most valuable section of an American city. New York abounds with examples of the improvement to property, its rise in value, and a consequent increase of the taxable basis by the extension of the subways. In a report of the Board of Park Commissioners of Kansas City for the year 1910, there were some most interesting and instructive data regarding the increase of land value due to boulevards. I make the following quotation:

¶INCREASE IN TAXABLE VALUES *is much more than the cost of land and construction necessary for carrying out proper civic improvement plans.*

"The figures given in this report, collected by the board's accountant, show the powerful influence which the establishment of the boulevards has had upon land values. On Benton boulevard, upon which the abutting property has responded in a less degree in increments of value than on any other boulevard of the city, it is shown conclusively that the increase in value has been more than 183 per cent. since the establishment of the boulevard, and that after deducting the cost to the property owners of every class of improvements with which this frontage has been assessed, and also deducting the average increase of land value thruout the entire district, which includes increments due to this and other park improvements in the same district, we have a clear net profit, demonstrably due to the boulevard, of approximately 44 per cent. But upon other boulevards, notably Armour, Gladstone, Linwood, Gillham Road and The Paseo, the land gain has been from 200 to 500 per cent., the greater portion of it being directly attributable to the establishment of the boulevards."

And so in various municipalities you will find concrete examples tending to show even to the most sceptical that city planning pays in dollars and cents as well as in the general comfort and living conditions of the citizens.

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Unfortunately we have no good examples of the results of excess condemnation. This method for the improvement of our municipalities is thought by some of the best experts in city planning to be the real key which will give to American cities a method and stimulus for large neighborhood improvements. Mr. Andrew Wright Crawford, who is intimately associated with the National Conference on City Planning, has given a good deal of study to this subject, and I think his published discussions on the matter are well worth the reading for those interested in civic improvements. Your committee, I note, made reference to excess condemnation in its report. I think all those who have given the matter any attention at all are highly in favor of adopting excess condemnation. But to put it into effect in most cities we will need additional and different kind of legislation. Europe has done wonders in excess condemnation, Germany being probably to the forefront in carrying out such principles. But to Americans interested in the subject, the form and methods adopted in England would probably appeal more strongly than would the methods adopted on the continent. London has issud a most interesting report on the creation, by excess condemnation, of the King's way. You will find this good reading and I think some of the ideas you will find possible to adopt in your plans for Louisville. We shall, of course, have to modify to a great extent the methods which the English adopted, but I can see no good reason why we should not begin to strive to obtain this much needed power in civic condemnations.

¶STREET TREES *and cross sections and like details are essential parts of civic beauty plans for they reach all streets and make them conform to the special beautifying features of parks, places and boulevards.*

Do not forget the details in your city planning. You must never lose sight of the importance of parks and boulevards nor must you forget the importance of the planting of trees along your streets. Within the past few years the progressive American cities have given much attention to forestry departments. The results in many communities have been most gratifying. Washington, of course, is almost ideal in this line. In Baltimore we are on our second year in this work. I do not mean, of course, that previous to this time trees were not planted on city streets, but two years ago we had prepared new legislation and created a separate city department to care for all matters pertaining to the planting, preserving and caring for street trees. The department has been a great success and each year will show more clearly the wisdom of our move. I hope you will see your way clear in Louisville to devote a good deal of time to this great adjunct for the beautifying of your city.

Still another detail which I think you would do well to keep constantly in mind in your future planning for Louisville is that of the cross-sections of streets. Baltimore, following the custom on vogue in many of our older cities, for many years constructed its streets along a general rule of thumb procedure, whereby one-fifth of the total width between building lines was used for each sidewalk and the remaining three-fifths wa sdevoted to the roadway. On some streets this proportion and allotment figured out very well, but on others it was decidedly bad and totally inappropriate, for it entailed the paving of a roadway much too wide for the needs of the traffic. Now, however, we have gotten away from such a poor method, or, rather, lack of method, of procedure and we now endeavor to adjust our cross-section to meet the demands of the thorofare in question. This is, of course, all a very simple matter, but I mention it as simply one of numerous details requiring attention in order to get the best results in your efforts at city planning.

I realize in the talk I have been giving that I have not laid as much stress as one might have thought proper on what I mentioned in the first place, that is, a topographical map as a basis for good city planning. But I have allowed myself to drift from the subject principally for the reason that from the nature of your profession I know full well that you do appreciate the absolute need of such a map in all forms of city planning, and I have thought it little use to dwell on the importance of something which you know yourself much better than I could possibly make known to you.

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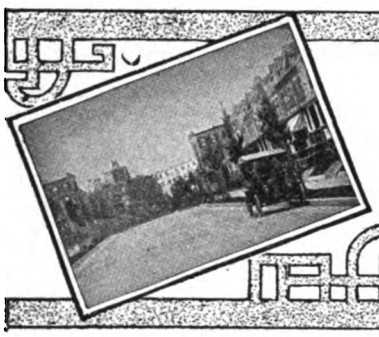

MISCELLANEOUS

An Aquatic Capital

The photograph on the front cover page shows the city of Brunei, which is the capital of the state or province of Brunei on the Island of Borneo. All the houses in the city are built on slender piles made from the Nibong palm, driven in the bed of the Limbang river, which evidently does not vary greatly in stage. It will be noted that the islands and the banks of the river are heavily wooded and are apparently not inhabited, the people preferring to locate their houses over the water.

The inhabitants are Malays, Kadayans, Orang-Buskits and a few Muruts, whose business is mainly trading with tribes living in the interior of Sarawak and British North Borneo. Their manufacturing industries are brass working, in which they are very skillful, and weaving cloth among the women. Agricultural activities are mainly limited to the growth of sago and rice in the valleys nearby.

A hundred years ago this city was the headquarters of the Borneo pirates and a center for the slave trade.

The municipal problems of such a city are many of them much simpler than those of a city on land.

Municipal Four Per cents at Par or Better

On November 9, 1914, the city of Philadelphia, Pa., sold $825,000 of four per cent. bonds over the counter at par before 11 o'clock of the first day of the sale, and when the offering was increased to $1,125,000 it was all sold within ten days, without any aid from banks. This repeals the city's experience of May 1, 1913, when an offering of $3,500,000 of four per cent. bonds was quickly taken and the offering

The city of Indianapolis did not find the retail sale of bonds successful, but placed one issue of $63,000 at a bid netting 3.99 per cent. interest.

That contractors and material men are anxious for work is shown by the report that at a letting for a small water works plant in northern Indiana there were 86 bidders present and 110 bids were offered requiring about four days to tabulate and compare to determine the successful contractors.

Lecture Courses for Health Department Employes

The department of health of the city of New York has organized series of lectures on sanitary science for its employes in four courses: For medical inspectors and other physician employes, 18 lectures; for lay food and sanitary inspectors, 24 lectures; for hospital nurses, 60 lectures; and for field nurses on infectious diseases and child hygiene, 20 lectures. All the lecturers give their services gratuitously.

Lectures can be obtained by organizations outside of New York on application to the Lecture Division of the Bureau of Public Health Education, Department of Health, 139 Center street, New York. It is understood that there is no charge for these lectures, tho all expenses of the lecturer and stereopticon, if used, should be paid.

Technical Schools

The University of Illinois maintains ten research fellowships in its engineering experiment station, open to graduates of approved American and foreign universities and technical schools. Appointments must be accepted for a period of

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The educational institutions in Cambridge, Mass., at the request of Mayor Good, have appointed advisors for the city on matters of taxation. Harvard University appointed Prof. Charles J. Bullock, a prominent authority on economics, and the Massachusetts Institute of Technology has appointed Prof. Chas. M. Spofford, head of its civil and sanitary engineering department.

The second annual short course in highway engineering of the University of Illinois will be given January 11 to 23, 1915. Several state highway engineers, professors, county superintendents of highways, township highway commissioners and road experts are on the list of speakers. Afternoons will be spent in laboratory demonstrations in testing materials, mixing concrete, etc.

"The Analysis of Coal with Phenol as a Solvent," by S. W. Parr and H. F. Hadley, has just been issued as Bulletin No. 76 of the Engineering Experiment Station of the University of Illinois.

American Road Builders' Convention

The fifth American Good Roads Congress and sixth Good Roads Show held by the American Road Builders' Association at Chicago, December 14 to 18, was well attended and both were most interesting and instructive. The distance apart of the two attractions interfered somewhat with the attendance at both, those having special interest in one finding it difficult to attend the other. The registration at the road show seems to have been about 1,500, which by no means measures the attendance, and the total registration was estimated as approximately 4,000.

The Congress was addressed by state, county and city highway commissioners from Wisconsin, Illinois, Ohio, New Jersey, New York, Colorado, Ontario, Arkansas, Pennsylvania, Connecticut, Massachusetts, Kentucky, Indiana, Iowa, Maryland, Michigan, New Mexico, Kansas, West Virginia, Louisiana, North Carolina, Maine.

The discussions covered all branches of the road problem; construction features, such as dimensions, foundations; organization, of department and divisions; traffic tendencies, development and regulation; machinery of construction and maintenance; brick, concrete, wood, stone, bituminous, earth and gravel surfaces for roads and bridge floors, standards of specifications and construction, legislation, convict labor, dust prevention and street cleaning.

About 125 manufacturers and dealers in road machinery and materials were represented by exhibits, many of them being handsome as well as interesting and instructive. Six photographs of exhibits are shown in the accompanying cuts, which with their titles are self-explanatory.

The educational features of the show were located about a small park and boulevard constructed in the center of the arena at the main entrance to the building. The "boulevard" was paved with sample sections of various pavements including Aztec asphaltic concrete of the U. S. Asphalt Refining Co., brick and creosoted wood block with Sarco filler and concrete surfaced with Sarco asphalt of the Standard Asphalt and Rubber Co., asphalt macadam and brick pavement with Standard asphalt and filler of the Standard Oil Co., asphalt macadam using Bermudez asphalt and asphaltic concrete paving using Trinidad lake asphalt of the Barber Asphalt Paving Co., Warrenite and bitustone pavements of Warren Brothers Company, Tarvia filled macadam with granite and limestone wearing surfaces of the Barrett Manufacturing Co., concrete of the American Portland Cement Manufacturers' Association, wire-cut-lug brick of the Dunn Wire-Cut-Lug Brick Co., Kreolite and hex wood blocks of Jennison-Wright Co., creosoted wood blocks of the U. S. Wood Preserving Co., Kettle River Quarries Co., Chicago Creosoting Co. and Ayer and Lord Tie Co., granite blocks of the Wisconsin Granite Co. and tarvid of F. J. Lewis & Co.

A boulevard lighting system and street signs of the Enamel Sign Co. of Chicago, added to the general beauty of the exhibit. The exhibits of the Chicago street department, the U. S. Office of Public Roads and highway commissions of several states and cities surrounded the boulevard.

Materials of construction and machinery were separated into the two groups. Exhibitors of materials included asphalts by Barber Asphalt Paving Co. with a moving picture show, see one of the accompanying photographs; U. S. Asphalt Refining Co.; John Baker, Jr., with Texaco and California asphalts, as seen in one of the photographs; Bitulithic by Warren Brothers Company, as seen in one of the photographs; Tarvia by Barrett Mfg. Co. with a moving picture show; Rocmac by the Rocmac Road Corporation of America; Glutrin by the Robeson Process Co.; brick by The Dunn Wire-Cut-Lug Brick Co., with their daily carnations for every visitor, and the National Paving Brick Manufacturers Association, both shown in one of the accompanying photographs; concrete building and road reinforcement and joint protectors by Trussed Concrete Steel Co., as shown in one of the photographs; as-

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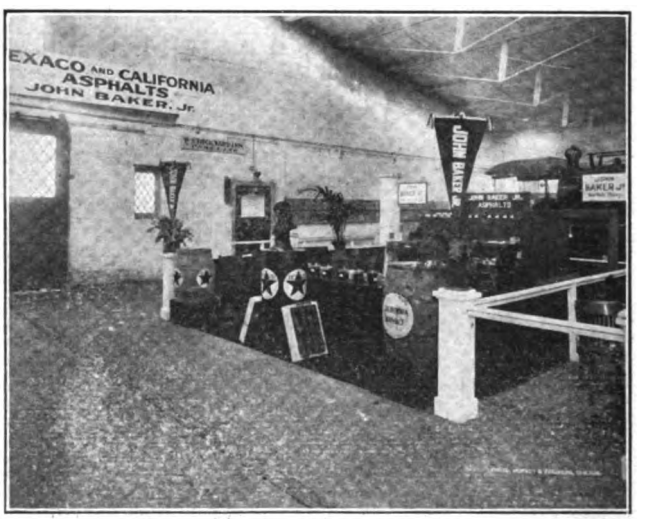
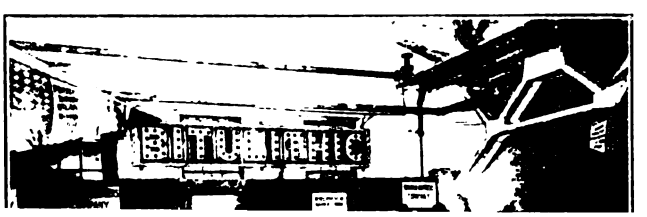
Trussed Concrete Steel Company, Detroit, Mich. Concrete reinforcement curb and joint protectors and waterproofing.



John Baker, Jr., New York. Texaco and California Asphalts.



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phalt paving plants by F. D. Cummer & Sons Co., by photographs and booklets; cement by Universal Portland Cement Co.; creosoted wood Kreolite and Hex blocks by Jennison-Wright Co.; Sarco asphalt for asphaltic concrete, expansion joints, filler for block pavements, wearing surface for concrete pavements, etc., by Standard Asphalt and Rubber Co.; inspection facilities for construction and materials by Robert W. Hunt Co.

In the machinery exhibits the Koehring Machine Co. had a prominent place with their paving mixers No. 6 and No. 16. one of them shown in an accompanying photograph; the Utility Road and Farm Machinery Co. with their Clark grader and trenching machine, Kelly-Springfield Motor dumping trucks; Austin-Western Machinery Co. with their new gasoline road roller; Erie Machine Shops with their new Erie steam roller; the Jaeger Machine Co. with their paving mixer; Knox Motor Co. with photographs and booklets regarding the tractor; Marsh-Capron Co. with their concrete machinery; Steel Protected Concrete Co., with their Wainwright steel protected curb; Turbine Sewer Machine Renovating Co., with their sewer cleaning machinery and photographs of results.

Limitations of space prevent completion of the list of which the above are representative.

Personal Notes

Arthur W. Dean, M. Am. Soc. C. E., chief engineer, Massachusetts Highway Commission, Boston, Mass., on December 3 delivered a lecture on "Specifications for Sizes and Physical Properties of Broken Stone," before the graduate students in Highway Engineering at Columbia University.

Sumner R. Church, manager, Research Department, Barrett Manufacturing Company, New York city, on December 7 delivered an illustrated lecture on "The Essential Physical and Chemical Properties of Creosote Oils for Wood Blocks," before the graduate students in Highway Engineering at Columbia University.

A. W. Dow, chemical and consulting paving engineer, New York city, on December 6 delivered an illustrated lecture on "Details of Construction of American Wood Block Pavements," before the graduate students in Highway Engineering at Columbia University.

George W. Tillson, M. Am. Soc. C. E., consulting engineer to the president of the Boro of Brooklyn, New York city, on December 11 delivered an illustrated lecture on "European Wood Block Pavements," before the graduate students in Highway Engineering at Columbia University.

George Prentiss Robinson, C. E., has retired from the office of city engineer of Santa Barbara, Cal., where he has had charge of extensive paving improvements, a 2,000-foot sea wall and several bridges. He returns to the general practice of civil engineering at 849 N. Mariposa Ave., Los Angeles, Cal.

John G. Evans has joined the sales force of the Marquette Cement Mfg. Co., at their Chicago office.

Technical Associations

The sanitary section of the Boston Society of Civil Engineers will meet January 6 and hear talks on "Diatoms" by Prof. Geo. C. Whipple, of Harvard University; F. F. Forbes, superintendent of water works at Brookline, and others. S. E. Tinkham, secretary.

The engineering section of the American Association for the Advancement of Science, meeting in the Engineering Building of the University of Pennsylvania, in Philadelphia, has a long program of papers for Wednesday and Thursday, December 30 and 31, which sustains the reputation of this organization for excellent work, tho it is evidently impossible to read all the papers or to discuss any considerable number of them in the time allotted.

The American Wood Preservers' Association will meet January 19 to 21, at Congress Hotel and Annex, Chicago, Ill. This is a working association whose value is demonstrated to engineers generally by the annual volume of proceedings. Membership is open to all engineers, professors, editors, producers of materials and others interested in the work covered by the title of the organization.

The twelfth annual dinner of the Municipal Engineers of the City of New York will be held January 16, at the Hotel Savoy, at 7 p. m. Geo. A. Taber, secretary.

The second National Foreign Trade convention, to be held in St. Louis, January 21 and 22, has for its objective greater prosperity thru greater foreign trade. Hon. W. C. Redfield, U. S. Secretary of Commerce, and John Basset Moore, formerly counselor of the U. S. Department of State, will open the convention. Authoritative papers by leaders in the business world, constructive discussion by delegates from all parts of the country, and ways and means for the smaller manufacturer and merchant to engage in foreign trade are the features of the program.

The special railroad rates for the Panama-Pacific and the Panama-California expositions at San Francisco and San Diego go into effect March 1, and are on the basis of $50 for the round trip from Missouri river points.

The Engineers' Club, of Dayton, O., be-

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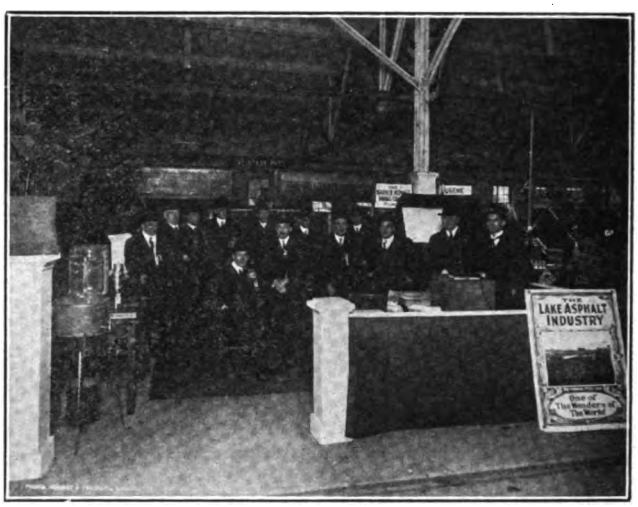
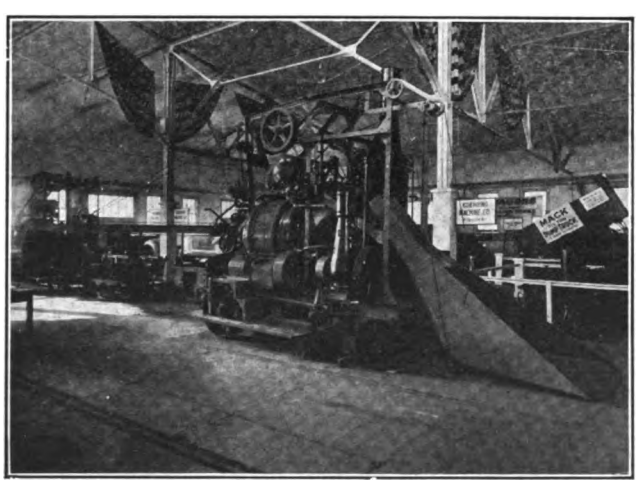
Dunn Wire-Cut-Lug Brick Co., Conneaut, O., and National Paving Brick Manufacturers' Association, Cleveland, O. Brick pavements.

Barber Asphalt Paving Company, Philadelphia, Pa. Trinidad Pitch Lake and Bermudez lake asphalts, asphalt pavements and bituminous surface roads.





Koehring Machine Company, Milwaukee, Wis. Concrete mixers and distributers.

EXHIBITS AT CHICAGO ROAD SHOW.

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gan its life practically on May 14, 1914, in a handsome clubhouse at Second and Madison streets, and is a new idea for a technical association outside the largest cities. It has already made itself felt in the city, and its influence can be extended indefinitely. The club will be the host of the American Society of Municipal Improvements at its convention, to be held in Dayton, October 18-22, 1915.

At the annual meeting of the American Society of Mechanical Engineers, held in New York, the sessions of December 3 were devoted to engineering in the administration of a city, with papers by prominent officials in the engineering departments of the cities of New York, Philadelphia, St. Louis and Cleveland, and others.

The American Society of Engineers, Architects and Constructors, at its monthly meeting, held in the United Engineering Societies Building, on Thursday, December 10, passed the following resolution: "That in view of the complex nature of modern engineering and architectural construction, which demands practical knowledge far in excess of the limits of one man, it is desirable, in the interests of our cities, that their municipal authorities should at times call in the assistance of experts for consultation with their own engineers."

The third annual meeting of the Montana Institute of Municipal Engineers will be held in Helena, Mont., January 18-20. Carl C. Widener, secretary, Bozeman, Mont.

At the annual meeting of the Brooklyn Engineers' Club J. S. Langthorn was elected president; G. Laurence Knight, vice president; Joseph Strachan, secretary; W. W. Brush, treasurer.

The Ohio Engineering Society will hold its thirty-sixth annual meeting January 20-22, in Brown Hall, Ohio State University, Columbus. The program includes papers on inclosing a stream thru Mansfield, by C. L. Bradley; an experiment in resurfacing a concrete road, by F. J. Stinchcomb, county surveyor, of Paulding; wire-cut-lug brick, by W. C. Perkins; culvert design, by P. K. Sheidler, of the state highway department; brick roads, by D. Moomaw, road engineer of Cuyahoga county; a recent public utility franchise, by Charles C. Brown, of MUNICIPAL ENGINEERING; the relation of the engineer to plans and work, by Will P. Blair, of Cleveland; the National Road, by J. T. Voshell, of the U. S. Office of Public Roads; the state highway department, by James R. Marker, commissioner; the Columbus sewage, garbage and water treatment plants, by Prof. F. H. Eno. John Laylin, of the state highway department, is secretary.

At the annual meeting of the New England Water Works Association, Desmond Fitzgerald will show and describe some travel lantern slides, and the report of the committee on filter statistics will be made and discussed. The president, Frank A. McInnes, will deliver his annual address and officers will be elected. The meeting will be held at Hotel Brunswick, Boston, Mass., January 13.

Publications Received

Water Supplies; Their Purification, Filtration and Sterilization; a handbook for the use of local and municipal authorities, by Samuel Rideal, D. Sc., fellow of University College, London, and of the Institute of Chemistry; public analyst for the metropolitan boro of Chelsea; and Eric K. Rideal, B. A., Ph. D., with numerous illustrations and tables. American publishers, D. Appleton & Co. Cloth, 274 pp.

Report of the fifth annual meeting of the Commission of Conservation of Canada, held at Ottawa, January 20, 21, 1914. Clifford Sifton, Chairman, Ottawa, Can.

Graphic Methods for Presenting Facts, by Willard C. Brinton, is one of the volumes of the Works Management Library, published by the Engineering Magazine Company, New York. Cloth, 370 pp. $4.

Civil Service Examinations

The United States Civil Service Commission will hold examinations at the usual places, as follows:

February 2: Sanitary engineer in Public Health service in the field at $2,500 a year.

February 3: Physical laboratorian in New York navy yard, at $3.04 a day; copyist marine engine and boiler draftsman in Norfolk navy yard, at $2.80 a day; copyist electrical draftsman in New York navy yard, at $3.28, and in Philadelphia and Puget Sound navy yards, at $3.04 a day; copyist ordnance draftsman in Washington navy yard at $2.80 a day; civil engineer student in the Office of Public Roads, at $720 a year; temporary topographic and under Geological Survey during field season, at $40 to $75 a month.

February 3, 4: Marine engine and boiler draftsman in Philadelphia navy yard, at $5.04 a day; electrical draftsmen in nevy yards and establishments, at $3.52 to $5.52 a day; ordnance draftsman in any U. S. navy yard or establishment or in Washington, at $3.28 to $5.04 a day; structural steel draftsman at Newport naval station, at $4 a day.

February 4, 5: Junior topographer in Geological Survey, at $720 to $1,200 a year.

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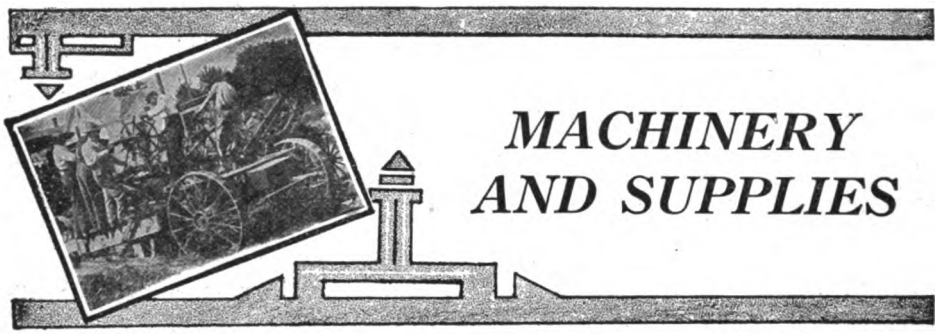

Street Signs and Sign Posts

In the December number of MUNICIPAL ENGINEERING, vol. xlvii, p. 482, is an article describing and illustrating very simple and economical as well as low priced designs for posts for street signs of various sorts and the enameled signs used on the posts. The paragraph giving the name of the company was lost from the copy for the article and so due credit was not given for the supply of a design which only needed to be known to become popular for general road work.

The Enameled Steel Sign Co., 222 North State street, Chicago, Ill., can supply the signs and will send on request a booklet giving full information about them and the prices at which the various designs can be furnished.

New Road Asphalt Paving Plant

R. L. Davis, contractor, Tampa, Fla., has just purchased a Cummer road asphalt paving plant to be used first at Tarpon Springs, Fla., for sand-asphalt roads. After completing this contract it will be shipped elsewhere for laying asphalt macadam.

This plant is especially adapted for this class of road work, because it consists of three units, power, asphalt kettles, drying and mixing; and each unit is mounted on its own trucks with broad wheels, making the complete plant easily moved along the road, and kept up with the work.

or to be jacked up and used in the following manner: When moved along the road, the mixture is taken away by means of wheelbarrows, and when it is jacked up, the mixture is taken to the work on the streets or roads in wagons or auto trucks.

There are also many of these road plants in operation in the East and Middle West.

A Damp Resisting Paint

Antkawa damp resisting paint is an indestructible compound of water-resisting and alkali-proof materials scientifically combined, which when applied to the inner walls of brick, stone, cement or tile, dispenses with furring and lathing.

Being plastic in its nature, it expands and contracts in unison with the surface to which it is applied and permits scratch coat of plaster to absorb sufficient so as to form a permanent bond between the wall and the plaster.

Applied on the interior of walls it seals them, making an air-tight, heat and cold insulating barrier, thereby reducing the radiation necessary for the heating of the building.

There being no space between wall and plaster, vermin are eliminated and a sanitary fire-proof construction is secured which not only economizes in space, but cost as well.

Antakwa prevents the alkali and saltpeter from penetrating the plaster and staining the decorations.

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ing, Chicago, Ill., the makers of the paint:

"We have about 50,000 square feet of faced brick on the interior walls of our new pumping station, the brick being a hydraulic dry pressed brick, buff in color. A great amount of efflorescence showed on the surface of this brick, all of which has recently been cleaned off, but in order to prevent a recurrence of this discoloration we are desirous of coating the brick with some transparent, colorless preparation which will prevent any exudation in the future.

"Understanding that you are manufacturers of the material to be used for the purpose indicated, I would be pleased to hear from you with full particulars regarding your product, giving the price, the amount required, and the guarantee which you would give with said material to prevent any further discoloration on the brick wall. I would also be pleased to know whether you would prefer to do the work yourself or whether the material can be applied by any skillful painter."

The application of Antakwa in two coats, which can be made by any good painter, will cure the difficulty at a cost of about 1 cent a square foot of wall, the covering capacity of Antakwa being 125 to 150 square feet per gallon for two coats.

The paint has been used in many hospitals, schools, apartment houses, theaters, office and college buildings for waterproofing and damp-proofing purposes, one large academy building requiring 5,750 gallons, tho 600 to 1,200 gallons is the usual amount applied in buildings of the classes named.

The Antakwa Company will give full detail as may be desired.

See America First New Year's Greeting

We are wishing you a pleasant journey through the coming year—

A journey that shall not be marred by skidding—

A journey in which there may be few rough spots—

A journey in which you may have Safety First, last and all the way—

A journey which may enable you to See America First in the galaxy of nations—

First in prosperity, First in Peace, and First in Honor—

A journey that shall bring you all the comfort, all the safety and all the steady going that accompany Goodrich Tires—

A journey during which every day may be a continuous round of pleasure—

Just as each Goodrich Tire is.

And may all your ventures prove to be for the Best in the Long Run.

The B. F. Goodrich Company,
Makers of Everything that's Best in Rubber.

A Safe and Tight Manhole Cover

The accompanying cut shows the D. and D. safety cover for manholes and its construction, so as to demonstrate that the design is one which prevents all rattling or dishing of manhole covers under street traffic. The lugs shown in the cut fit into each other very snugly and prevent any noisy motion.

The South Park Commissioners of Chicago have installed the covers on some of the South Side boulevards, made of the Chicago city street manhole size, weighing 540 pounds complete. They are also in use by the electrical department of the city of Chicago and by the water department. The dimensions of the 540-pound cover are 24-inch diameter of opening, 36-inch diameter of bottom flange.

Except for the more perfect fit of the lid, the cover is in all respects the same as the ordinary manhole required by Chicago specifications. The advantage is in the tightening and wedging of the lugs on the lid upon the lugs on the inside of the manhole ring.

The lid is as easy to remove as the ordinary manhole cover lid, because the lugs are so constructed that frost or dirt do not affect the removal.

The difference in difficulty of making the castings makes the price a little higher than the ordinary cover, but its safety from tipping and the absence of rattling more than make up for the small difference in cost. Cities adopting it will at once appreciate its good points. Coal-hole covers, water caps or any like manhole covers are safer if of this design.

The cover is put on the market by Wm. E. Dee Company, Stock Exchange building, Chicago, Ill.

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Steam Melting Asphalt Plant

Some years ago, certain advanced asphalt experts discovered that asphalt, after having been overheated, lost the greater part of its usefulness.

The Merriman plant was equipped with steam coils to prevent this destruction, and for a period of ten years, no asphalt pavement that was mixed by this plant has either gone to pieces totally, or in patches, on account of burned asphalt having been used in the mix.

It has demonstrated its capacity of 2,800 square yards of 2-inch sheet asphalt top in ten hours and a corresponding proportion of asphaltic concrete. The mixer is the equivalent of 12 cubic feet. All power transmission is protected from the fine sand and the cost of repairs has been very low as a consequence.

The East Iron & Machine Company, of Lima, O., will furnish any further information regarding this plant.

Watson Corrugated Culvert Patent Valid

The large number of manufacturers of corrugated culverts in the United States operating under the Watson patent, have just been informed by their attorney, Wallace R. Lane, of Chicago, that the United States Court of Appeals for the second Circuit, having final jurisdiction, has just handed down a mandate reversing the lower court and holding the Watson corrugated culvert patent valid and infringed by the culvert installed by a highway commissioner in New York. In brief, the court holds:

"The Watson patent has been so thoroly discussed in the opinions of the District Court and of this court, that it will serve no useful purpose to repeat in detail what is there said regarding the patent and the disclosures of the prior art. The patent is for a corrugated metal culvert. It is unusually plain and simple.

"In brief,, the claim is for a sheet metal culvert composed of connected cylindrical sections having circumferential corrugations extending to the extremities of the sections. Each section terminates at one end in a flared and at the other end in a contracted portion of a corrugation, so that two sections may interlock, the ends being held in place by bolts or similar means. The corrugations greatly strengthen the culvert and the doubling of the corrugations at the joints braces and adds stability in the structure.

"In short, the patented culvert is cheap, strong, durable, easily transported, quickly laid down and easily repaired.

"We cannot believe that the man who gave such a structure to the world should be denied the title of an inventor.

"The fact that Watson, during the early years of his patent was almost invariably repulsed by those interested in the art because they thought his device empirical, inefficient and perishable, is persuasive to the conclusion that his improvement was not obvious.

"In view of the phenomenal success of the patented pipe after the public became aware of its advantages and the strength and durability which it has developed after years of trial, we are of the opinion that any doubt as to patentability should be resolved in favor of the patent.

"The practical and commercial success of the Watson culvert is so clearly shown that we find it difficult to believe that a mere mechanic could have produced a culvert which has so revolutionized the art, a culvert which has shown a durability which no one at the time of the invention thought possible.

"We have here not only the circumstances that the new device has commended itself to the public and gone into extensive use. This sometimes happens because of judicious advertising and clever business methods.

"The early history of the patentee's experience is illustrative. For years after the issue of the patent he labored unsuccessfully to introduce his culvert. The persons whom he urged to try his device, persons engaged in road building and under-draining, declined to do so because it seemed to them very doubtful whether it would endure, and opposition was overcome only after he had actually built a few culverts and demonstrated their capacity to remain efficient after years of use. This circumstance indicates that simple tho it is, the Watson culvert is a device which would not have suggested itself to the ordinary road-builders.

"Infringement is clearly shown; the two structures are almost identical and the only differences are of form and not of substance. The defendant passes the rivets thru the metal at a point further from the ends of the section by less than an inch than in the complainant's structure. The difference is trivial and nothing functional is accomplished thereby.

"The decree is reversed with costs and the cause is remanded to the District Court with instructions to enter a decree for the complainant in the usual form."

The manufacturers of corrugated culverts under this important patent, including the National Corrugated Culvert Mfg. Co., of Middletown, O., make them out of Armco American ingot iron.

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Waterproofed Coatings of Surfaces

Before applying the waterproofed coating the surfaces must be especially prepared that a suitable bond be obtained. In fact, this preparation of surface is most important and many of the past failures in the application of the process may be attributed to the lack of care in this operation.

The proper bonding face is obtained by thoroly roughening, cleaning and grouting the surface. The wall or floor slab must be saturated with clean water to destroy excessive capillarity, for otherwise the pores of the masonry will absorb a large percentage of the gaging water, together with the finer particles of cement, and the strength and efficiency of the coating be impaired. Particularly in the case of brick walls or floors should the members be thoroly wet down, owing to the great absorptive property of this material. A slight amount of absorption is desired, however, as it assists materially in obtaining the necessary bond.

In the case of concrete walls the entire face is chipped to expose the aggregate, while for brick and rubble the joints are raked and the surfaces roughened. For floors it is highly advantageous to apply the waterproof coating the day following the placement of the concrete slab in order to simplify the bonding operation. When the coating is applied over old concrete floors similar precautions as for walls must be observed.

The cement coating is prepared by an intimate mixture of Portland cement and coarse sand with the incorporation of an Integral waterproofing compound, such as Trus-Con Waterproofing Paste, made at the Trus-Con Laboratories, Detroit, Mich. Proportions of 1 part cement to 2 parts sand are best adaptable for the purpose, as mixtures considerably leaner than this are too porous, whereas coatings of richer mixtures have a tendency to crack under temperature changes.

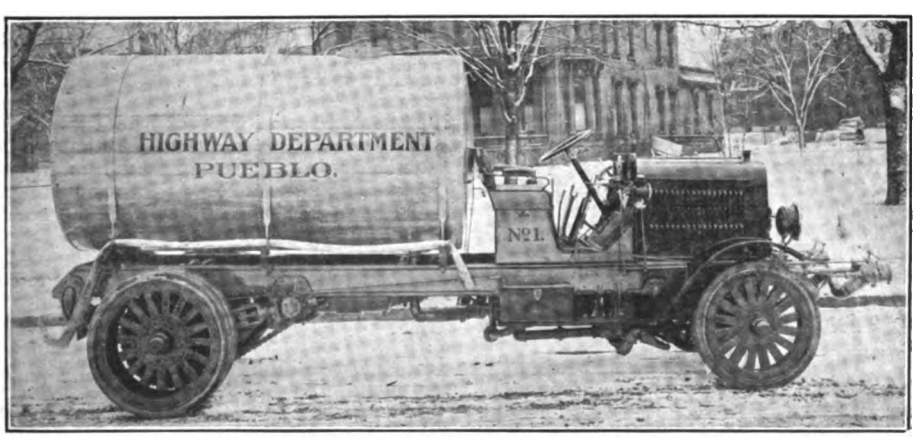
For waterproofing vertical surfaces the coating is applied in two coats, scratch and finish, giving a total thickness of ¾ to 1 inch, while for horizontal surfaces the coating is placed in one operation 1 to 2 inches in thickness. The second coat for vertical surfaces should follow the first at an interval not exceeding eighteen hours under normal conditions, as after final set has taken place, the pores of the waterproofed scratch coat, being negative in capillarity, tend to repel the grouting particles of the finish coat, resulting in a lack of adhesion.

Pueblo's New Street Sprinkler and Flusher

The city of Pueblo, Colo., has purchased from the Kissel Motor Car Company a motor-driven street sprinkler and flusher that is, in many particulars, quite different from anything of the kind heretofore produced.

The tank is mounted on a six-ton chassis, the largest made by the Kissel company. The car, loaded and fully equipped, weighs about twelve tons and carries 1,500 gallons of water. It is designed to do away with at least fourteen horse-drawn rigs. A letter regarding the tests made of this vehicle says, among other things:

"The water pump, when used for flushing, requires about 8 horsepower at 50



KISSEL *street sprinkler and flusher in use in Pueblo, Colorado. Sprinkler heads in front; flushing nozzles in rear of front wheels.*

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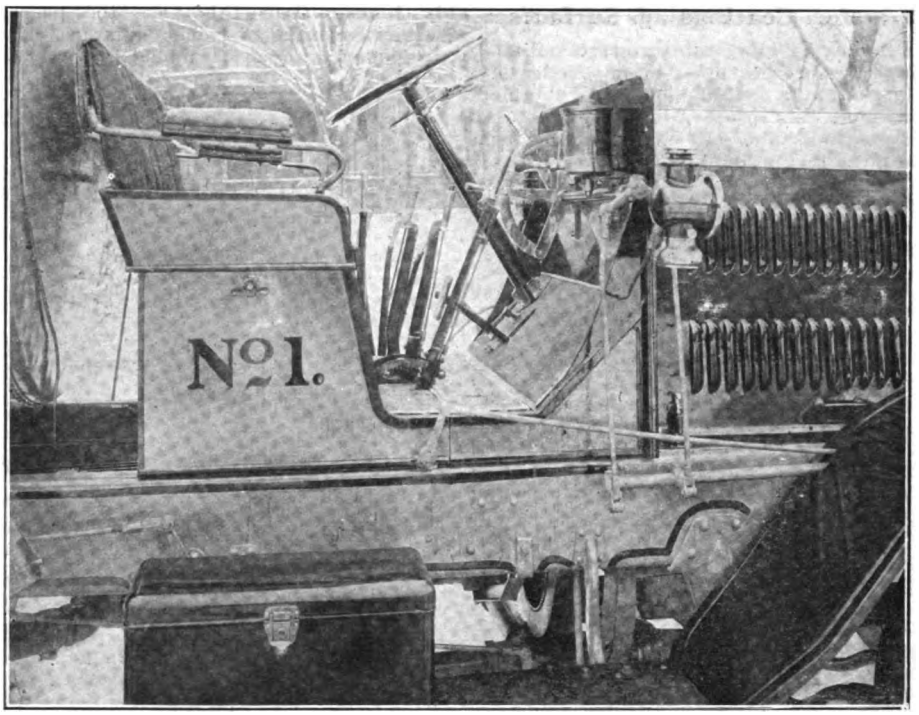

LEVERS *of Kissel street sprinkler and flusher, for controlling motor, pump, each sprinkler head and each flushing nozzle.*

pounds pressure, but we find the motor picks up this load, together with that of the car, in a surprisingly easy manner. We are very much pleased with the rig as a whole."

Power Traction Trench Tamper

The P. and H. trench tamper is not only an efficient tamper of material to fill excavations, but is equally efficient as a cutter of asphalt and a breaker of concrete.

Some of the features of the machine are the following:

1. The wheels are carried on stub axles of steel that may be raised or lowered 5 inches, on either side, from the center of the upright members of the main frame to which they are attached. This device makes it possible to keep the machine level tho one wheel be on ground 10 inches higher than the other.

2. The axles of the tamper are carried out far enough to allow of widening the wheel tread 12 inches on either side, 24 inches in all. The minimum tread is 4 feet 8 inches and the maximum is 6 feet 8 inches. It is not necessary to move both wheels unless desired, as it may be necessary to leave one wheel close to the trench on account of narrow berm. This may be regulated to suit conditions and the wheels may be placed at any point within the range of adjustment.

3. The tamping head moves across the machine on a solid steel runway provided for it. The weight of the entire machine is carried on 6-inch rollers and is evenly distributed. The tamping head is 12 inches wide and has a maximum cross travel of 20 inches, enabling it to actually cover 32 inches of trench. Since it is not necessary to tamp closer than 4 inches to the wall of the trench in most cases, the machine will handle a 40-inch trench. The tamping ram is operated by means of a large segment brought in friction contact with the hardwood ram by spring pressure on a large pulley on the opposite side of the ram. This segment is caused to revolve from 50 to 60 times per minute and, of course, causes a stroke of the ram at every revolution. This stroke has an average of 22 inches travel, and, as the ram and tamping head together weigh 150 pounds, a thoro packing of the earth results. When

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it is considered in comparison with hand labor the machine shows its worth very forcibly. It is pointed out that a good laborer with even a 15-pound tamper will not average more than 20 strokes a minute and will hardly ever lift the hammer more than 9 or 10 inches, as compared with the machine's 150-pound ram, 22-inch stroke, 60 a minute and "do it all the time."

4. The traction tamper moves entirely under its own power. The engine is throttle-governed with jump-spark ignition and is water-cooled. A speed of 1 1-3 miles per hour is provided for road traveling, tho this may be varied by changing the engine governor. A feeding speed, ranging approximately from 10 to 25 feet per minute, is provided to furnish a continuous slow movement forward when at work. A suitable reverse is provided for convenient movement of the machine.

It is claimed that the machine will do the work of 8 men in tamping, on the average; of 7 men in cutting asphalt, and of 3 men in breaking concrete. Its average speed of work is 1,080 square feet of tamping per hour, 145 linear feet of asphalt cut or 54.6 square feet of concrete broken up. It operates with one man.

Pawling and Harnischfeger Company, Milwaukee, Wis., are the manufacturers of this labor-saving and efficient machine and will give full detail of actual results and references to jobs on which it has been used.

Gypsum as a Fireproof Material

A very interesting and valuable treatise on "Gypsum as a Fireproof Material," by H. G. Perring, Assoc. M. Am. Soc. C. E., is published by the United States Gypsum Co., 205 West Monroe street, Chicago, Ill., and can be had for the asking. The conclusions of the article, aside from the examples of actual service, may be stated briefly in the following paragraphs:

Analyzing the special features of Gypsum plaster in general, which make the material desirable as fireproofing, we find the following points:

1st. Low heat conductivity is an essential point. In partitions heat is not conducted thru to set fire to furnishings, etc., on the opposite side. In the protection of structural steel work the steel is protected from the weakening action of heat. Many fires attain a temperature of 2000 degrees F. At 1700 degrees F. a steel column can only bear its own weight. The heat penetrates the plaster at such a slow rate that in the fires of ordinary duration the metal would hardly get warm.

2nd. Tests and experiments have failed to indicate any appreciable expansion of plaster under heat action. An inherent quality of all other forms of fireproofing is high expansion, resulting in a tendency of the fireproofing to wreck itself either by buckling, or, in the case of material of tile shape, the cracking off of the tile face. This destructive element does not enter into Gypsum fireproofing.

3rd. Materials of a nature that expand under heat readily contract when water is applied to the heated surface. This contraction is often so severe as to cause the bursting of the material. Plaster partially recalcines under high heat action and the subsequent application of water removes this recalcined portion. Plaster being a fairly soft material is eroded to some extent by water at a high pressure, but plaster fireproofing generally will withstand severe water application, there being no indication of the bursting so common in other materials.

4th. Any material to be used for fireproofing must not burn or support combustion. Plaster is incombustible.

5th. Lightness is essential in fireproofing, as the fireproofing at best is dead load on a building and plays no part in the support of the structure. Plaster is the lightest practical fireproofing material. Its use reduces the load on structural sections and in case of fire makes the building less liable to collapse.

6th. Plaster fireproofing has sufficient strength for use in partitions, column covering, etc., and in fires will stand up reliably against the impact of fire streams.

7th. Plaster is adaptable to any form of construction. Where used in slabs they are readily sawed or cut to fit any desired location and the use of the material in the plastic state will cover any possible condition of construction.

8th. The desirable fireproofing material is one that combines all the fireproofing features with low cost.

It is only by such a combination that the building of fireproof buildings will be encouraged. Plaster is in itself low of cost. Because of its lightness it reduces the load on a building, thus allowing a lessened amount of structural material.

Its lightness makes it more easily handled. Its adaptability, the ease with which it is sawed, etc., makes the construction of fireproofing easy. Trim can be nailed to plaster fireproofing without the use of wood blocks or grounds, saving the cost thereof and omitting combustible material from the building. Plaster blocks or boards are true and even and reduce the cost of plastering to a minimum.

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Sidewalk Science

A booklet on sidewalk, curb and gutter construction is issued by the Hotchkiss Lock Metal Form Co., of Binghamton, N. Y., which should be in the hands of every engineer or contractor interested in the construction of such improvements, whether they are users of the metal forms or not, because it so thoroly demonstrates the principles of right construction of concrete work, particularly in walks and curbs. The company will send the booklet, "Sidewalk Science," on request. It is worth sending for also for the many novel ideas in the use of forms for the special constructions so common in connection with private walks, steps, sidewalk, blocks, curb and the like with which it is filled.

An Electric Calculating Machine for Engineer and Contractor

Among the inventions of the past few years there is no one which offers more relief from mere mental drudgery in engineering work than the electric calculating machine. This electric calculating machine puts keys at the beck of the finger tips which enable the engineer to instantly solvè all kinds of problems in multiplication, division, addition, and subtraction.

In the accompanying illustration of the Ensign electric calculating machine is shown the working face of the Ensign machine, the motor and drive and tubular stand on which they rest being the necessary but uninteresting part of the detail of operation.

This machine handles multiplication, division, addition and subtraction with amazing rapidity, taking all work up to and including 9 figures by 7 figures and giving the complete result to 20 places. It operates so rapidly that it will take care of the work of the most speedy operator, and by the use of a series of proof dials, the work may be checked at the time the calculation is made, thus eliminating the need for a second checking of even original calculations.

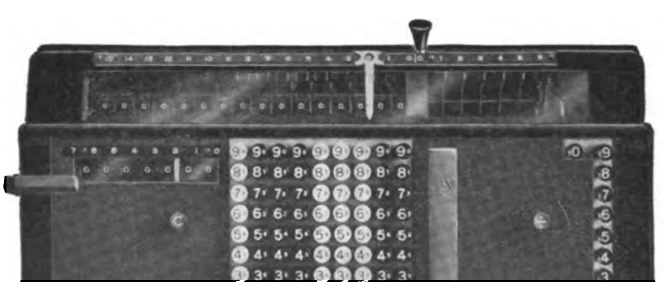
The nine rows of keys are adding keys, addition being performed by merely striking the proper keys—which remain depressed—then touching the adding bar at the right of the keys, which instantly releases the keys and registers the amount or adds it in—the result appearing in the result meter dials, just above the adding keys.

The keyboard is flexible so that errors may be instantly corrected by merely striking the proper keys, as the amounts are not calculated in until the adding bar is struck, in addition, or the proper key in the multiplying keyboard, for multiplication and division work.

The single row of keys at the right is the multiplying keyboard. To multiply you merely depress the proper keys in the adding section representing, say 467, 892, 375, and then depress the proper keys for the multiplier in the multiplying keyboard, say 6, 731, 837—beginning with the right hand figure, the same as if multiplying with pencil and paper—and the moment the last figure of the multiplier is registered in the multiplying keyboard, the result or product (in this case it would be) will appear in the result meter, and the figures of the multiplier (6, 731, 837) will appear in the proof dials at the left of the adding keyboard. The keys previously depressed in the adding keyboard remain depressed. Thus the operator may instantly check back the work to see that the amounts multiplied, or divided, have been properly recorded, and thus know that the work is absolutely correct.

In division work, the quotient appears at the left side in the result meter dials and the proof of the quotient in the proof meter dials.

This feature of proof and ability to in-



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stantly check all operations is a most important feature, as this enables a user of this machine to save all cost for again checking the work, which in many cases will split the cost of handling all figuring right in two, especially in cost accounting, pay roll work, tabular engineering figuring, estimating, etc., to say nothing of the great speed of the machine, which saves three-fourths to four-fifths of the time over pencil and paper calculation. When the time of a valuable employee or an engineer is involved, the cost of this machine may be easily saved in a very short time.

The "C" key (constant button) when depressed, will lock any constant figure in the adding section, so that repeated multiplications may be made, where the multiplicand is the same for a number of multiplications, by simply pressing the keys in a multiplying keyboard, which represent the figures of the different multipliers.

The Ensign electric calculating machines are all electrically operated, but have automatic control, the motor being instantly cut out the minute the operation is performed, so that little current is consumed and the motor need never be left with current turned thru it.

J. P. Sharpe, western sales manager, 72 West Adams street, Chicago, Ill., will give any further detail desired.

Specifications for Standard Brick Pavements

The National Paving Brick Manufacturers' Association, thru a committee of practical and experienced civil engineers, road builders and manufacturers of paving brick, all of whom have had many years of experience with the building of brick roads and pavements and the manufacture of paving brick, have prepared and published "Specifications for the Construction of Vitrified Brick Street Pavements and Vitrified Brick Highways." In this effort they have endeavored to give the best economical value in the use of paving brick possible; durability, satisfaction in use, ease of traction and a maximum of sanitation.

The association stands ready to render such personal assistance thru its engineering department as may be desired, to the end that the highest and most perfect type of pavement possible will result.

They have made it easy for engineers to inspect good work and to see what results from poor work. They firmly believe in the principles of their manner and method of brick road construction and great public welfare and advantage will follow their use and adoption.

Copies of the latest edition of these specifications will be sent on request by Will P. Blair, secretary of the association, B. L. E. building, Cleveland, O.

Medusa Waterproofing

Medusa waterproofing is a dry white powder and consists of fatty acids, chemically combined with lime. Owing to its extreme fineness it may easily be perfectly mixed with cement in the necessary proportions.

Medusa has now been on the market several years, is the original concrete waterproofing, patented in 1907, and has been used in every part of the world under every condition and in every character of construction in which Portland cement is used.

To render cement work impervious to water a small quantity of the waterproofing is thoroly mixed with the dry cement before the addition of sand and water. For most purposes from 1 to 2 per cent. of the weight of cement used will be found sufficient. This is equivalent to from 4 to 8 pounds of waterproofing 1 barrel of cement. The precise amount to be used must be left to the experience of the user and depends upon the proportion of sand etc., employed, and on the kind of work to be done.

Thoro mixing is of the utmost importance.

Medusa waterproofing is not soluble, therefore after mixing it dry with dry cement, add sand and mix thoroly; then add water slowly until desired consistency is secured. This will prevent the waterproofing being washed out of the mixture.

It is well known that comparatively poor mixtures of cement, sand and gravel or stone are abundantly strong for most purposes. The drawback to these poor mixtures is their porosity, which causes them to absorb water like a sponge. So-called water-tight mortar may be made by using a large proportion of cement or cement and lime, at great cost. We have found that cement with 1 per cent. of Medusa waterproofing, with five parts sand, gives a more impervious mortar than ordinary untreated cement with two parts sand.

Medusa waterproofing does not affect the color, strength, setting or hardening qualities of concrete and when used in proper proportions it will make any concrete work impervious to water and prevent discoloration from rain.

Medusa waterproofing prevents the white efflorescence which so often renders cement work unsightly; also prevents the appearance of hair-cracks on the surface.

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Its use in facing mixture gives satisfactory results.

For mortar, plaster and stucco, use 1½ to 2 per cent. mixture; this means 1½ to 2 pounds waterproofing to each sack of cement or 6 to 8 pounds to a barrel. Mix thoroly while dry. This percentage in a mix of 1 part cement and 2 parts sand is recommended for stucco work as well as plaster for waterproofing cellars, reservoirs, water-tanks, cisterns, foundations, etc. For cement floors and roofs it is only necessary to use a 2 per cent. mixture in top or finishing coat.

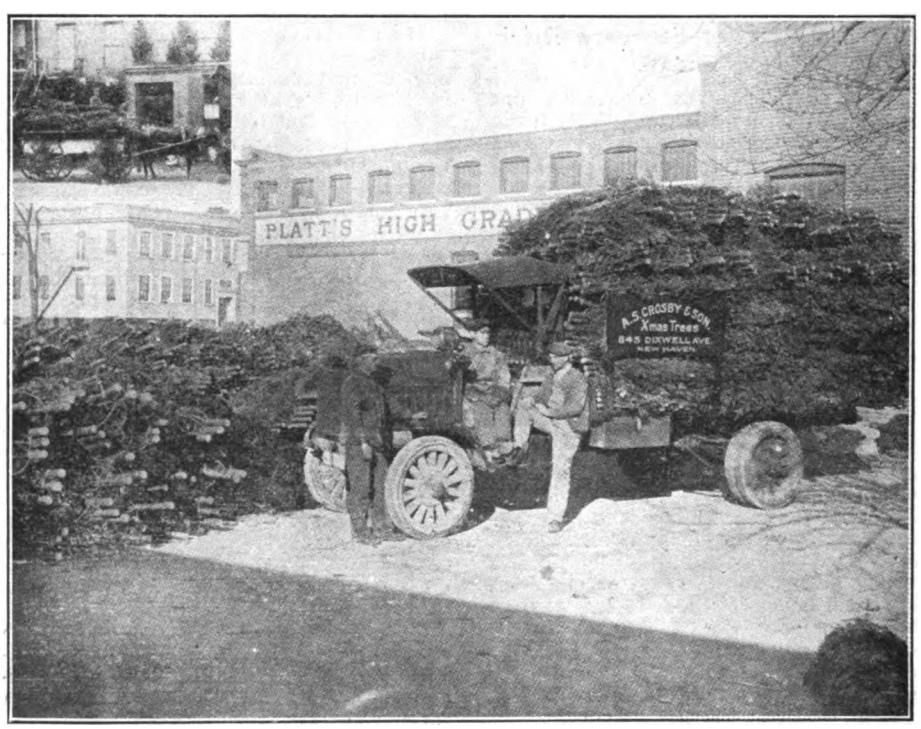
For a wash use 1½ per cent. mixture; this means 1½ pounds waterproofing to each sack of cement, or 6 pounds to a barrel. Mix thoroly while dry. Put a portion of the mixture in a pail, add water slowly and sufficient to make a paint of the consistency of cream. Keep agitated with a stick while in use. The surface must be thoroughly wetted, and the wash applied evenly with a brush. The coating must be thin, or hair-cracks are likely to develop. This mixture will give a waterproof surface.

A new booklet issued by the Sandusky Portland Cement Co. goes into much detail as to the uses of Medusa waterproofing and the success met with by many users.

Auto Truck for Oil Delivery

Some interesting facts regarding the distribution of oil by means of a motor truck comes from the Morlite Oil Company, of Warrensburg, Mo. This company has a 1½-ton KisselKar truck, fitted with a tank of 500 gallons capacity, which is used for the wholesale delivery of kerosene and gasoline to stores thruout the country. There are fourteen of these stores situated from 6 to 20 miles apart, each of which is served once a week. In addition, the truck delivers to twenty-two stores in Warrensburg, these deliveries being made daily.

The delivery equipment of the Morlite company consists of this one KisselKar truck with a crew of driver and helper, while that of a competing firm comprises two-horse teams operated by three men. The horse teams together make on an average of 25 miles per day, working from early morning until late at night and sometimes visiting but one of the country stores. The truck, on the other hand, makes the city deliveries first and then delivers to six or seven of the country stores, returning to the city by four



KISSEL TRUCK *making Christmas tree deliveries in New Haven, Conn.*

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five in the afternoon, after covering from 30 to 50 miles. The owners state that the average monthly consumption of gasoline and lubricating oil, respectively, is 100 gallons and 5 gallons.

Specifications for Bituminous Road Binder

The following specifications followed carefully will insure an excellent material for bituminous road construction:

A bituminous road binder in order to be eligible for use under these specifications for the construction of a bituminous surface, of the type herein called for, must comply in all respects with the following practical and established tests for the purpose hereinafter stated.

The bid of each contractor must specifically state the brand of bituminous road binder which he proposes to use. He must give the name, nature and chemical analysis of the material to be used, and where and by whom produced. His bid must be accompanied with a sample of at least one pound of it, properly marked and identified. Bids which do not comply with this requirement will be rejected as irregular.

Test 1—Ductility: In order to demonstrate the cementitious or adhesive character of the bituminous road binder, such binder as used must have a ductility of not less than 50 centimeters at 77 degrees F., according to the District of Columbia standard.

Test 2—Specific Gravity: In order to demonstrate that the bituminous road binder is of an asphaltic and cementitious character, as distinguished from an oily and non-cementitious character, and to preserve the proper balance between its adhesive and cohesive qualities, the specific gravity shall be not less than 1.04 at 77 degrees F.

Test 3—Paraffine Scale: In order to further demonstrate that the bituminous road binder is of an asphaltic and cementitious character, and to insure against the excessive use of non-cementitious materials produced from oils having a paraffine base, the bituminous road binder must not contain more than one-half of one per cent. of paraffine scale, as determined by the Holde method.

Test 4—Penetration: In order to demonstrate that the bituminous road binder proposed to be used is of the proper degree of consistency, it must, when tested for five seconds at 77 degrees F. with a No. 2 needle weighted with 100 grams, have a penetration of at least 12 millimeters and not more than 15 millimeters.

Test 5—Volatilization: In order to demonstrate that the bituminous road binder is of a sufficient stability to insure against loss of consistency and cementitiousness upon being subjected to working heat, it shall meet the following test: When 50 grams of the bituminous road binder are heated in a dish 2¼ inches in diameter for seven hours at 325 degrees F., the loss shall not exceed 3 per cent. and the penetration and ductility of the residue shall not be reduced more than 50 per cent. from its original consistency and ductility.

Test 6—Viscosity: In order to demonstrate that the bituminous road binder is of the proper degree of viscosity, and to demonstrate that such binder has a sufficiently low melting point to insure its penetration to a sufficient depth when poured upon or over the cold stone (or to insure its mixing properly and conveniently with the mineral aggregate), it shall have a float test of not more than five minutes at 150 degrees F., as determined by the float test apparatus manufactured by Howard & Morse, Brooklyn, N. Y.

Test 7—Purity of the Bituminous Road Binder: In order to demonstrate the percentage of bitumen in the bituminous road binder, and in order to regulate the uniformity of this material, it shall be soluble to the extent of at least 95 per cent. in carbon disulphide.

Test 8—Flash Point: In order to insure safety of operation the bituminous road binder must show a flash point (New York State closed oil tester) of not less than 325 degrees F.

Test 9—Durability: In order to demonstrate that the bituminous road binder is sufficiently stable and durable, it must not suffer a reduction in ductility of more than 10 per cent. from its original ductility after it has been incorporated in the paving mixture and extracted therefrom with purified carbon disulphide.

Test 10—Standard: Any bituminous road binder to be eligible for use under these specifications must be in all respects equal in quality to the standard bituminous road binder produced from refined Bermudez Lake asphalt; but whether the binder used is produced from refined Bermudez Lake asphalt or otherwise, it shall not be considered as complying with these specifications unless it complies with each and all of the tests hereinabove specified.

Tire Abuses

"Overloading and overspeeding trucks are prime causes of premature solid tire breakdowns—there are increased expense for the truck user, "time out" for frequent renewals, controversies in regard to adjustments, premature discard of tires

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and dissatisfaction with trucks." Mr. S. V. Norton, manager of truck tire sales for the B. F. Goodrich Company, thus sums up his paper on "The Causes and Effects of Overloading and Overspeeding in the Truck Tire Field," before the Motor Truck Club of America.

"The immediate effect of overloading and overspeeding," said Mr. Norton, "is premature tire destruction due to a greater liability to cuts, base separation from excess loads, friction and strain of skidding, weakening of a dual tire if the mate is injured, and overheating with constant disintegration of the rubber. Truck owners naturally desire to get as much work as possible out of their trucks and they may be led to overspeed them. If a truck owner wants to make 'intensive deliveries' he must pay for overspeeding in his tire bills. However, the trucks are often overspeeded without the owner's knowledge, owing to the driver's desire to make a good showing either with the loaded truck or by returning from a trip in quick time. Often drivers speed merely for the sake of the spare time gained

"Overspeeding as a rule is entirely unnecessary, as it need not be due to the absence of a governor or to the power of the truck. Down grades, easy riding, lack of obstacles and extra speed in car tracks all lead drivers to overspeed.

"The causes of overloading are usually due to improper or disproportioned tire equipment or to excessive or poorly arranged loads. Trucks are often overloaded owning to the ignorance of the owner as to what his trucks can safely carry. Loads may be placed too far back or forward on the body of the truck, even tho the loads are within the limits of the tire schedule of carrying capacities.

"Tire equipment may be disproportioned; tires may be too large on one axle and too small on the other, or the body may be too large for the tires. A large body may be allowed to pass unquestioned by a truck agent who is anxious to clinch a sale. This danger may not have been fully explained by the truck salesman when the truck was purchased or the owner may be too occupied to know what is going on. The ignorance or indifference of the driver may also be causes of overloaded trucks.

"One effect of the widespread abuse of tires thru overspeeding and overloading is a stimulation for better tires to meet the present conditions. The defects caused by overloading or overspeeding are usually brought home to the time manufacturer. However, tire makers are meeting conditions by educating all concerned in the proper care of tires, by adopting more rational guarantees, and by improving the tires themselves to meet every possible condition of service."

The B. F. Goodrich Company, for instance, has prepared a series of folders which deal at length with the common causes of tire abuses and remedies for such abuses. These folders, which will be sent to any truck user upon request, cover the following causes of truck tire breakdowns ':'Neglected Cuts," "Overloading," "Running in Car Tracks," "Bad Roads," "Skidding,' "' Anti-Skid Devices," "Wheels Out of Alinement,' 'and "Overspeeding." These valuable pamphlets are distributed from the Goodrich branches in all principal cities, or from the factory at Akron, Ohio.

Johns-Manville Co. Gets Big Pipe Covering Contract

The pipe insulation contract for the new Utah state capitol at Salt Lake City, for which R. K. A. Kletting is the architect, and Jas. C. Stewart Co. are the contractors, was recently awarded to the H. W. Johns-Manville Company.

The high pressure pipes will be covered with J-M asbestos-sponge felted pipe covering, a product made up of laminations of felt composed of asbestos and finely ground sponge. The materials being naturally cellular, they form the basis for the claim that this covering confines more "dead air" cells than any other covering—and therefore possesses higher heat-insulating value.

The heating pipes will be covered with J-M asbestocel pipe covering, which is built up on the arch principle. Sealed air channels run around the pipe, instead of parallel with it, thus preventing the circulation of air and consequent heat radiation.

UTAH STATE CAPITOL *building in which heat-insulation by J-M system is to be installed.*

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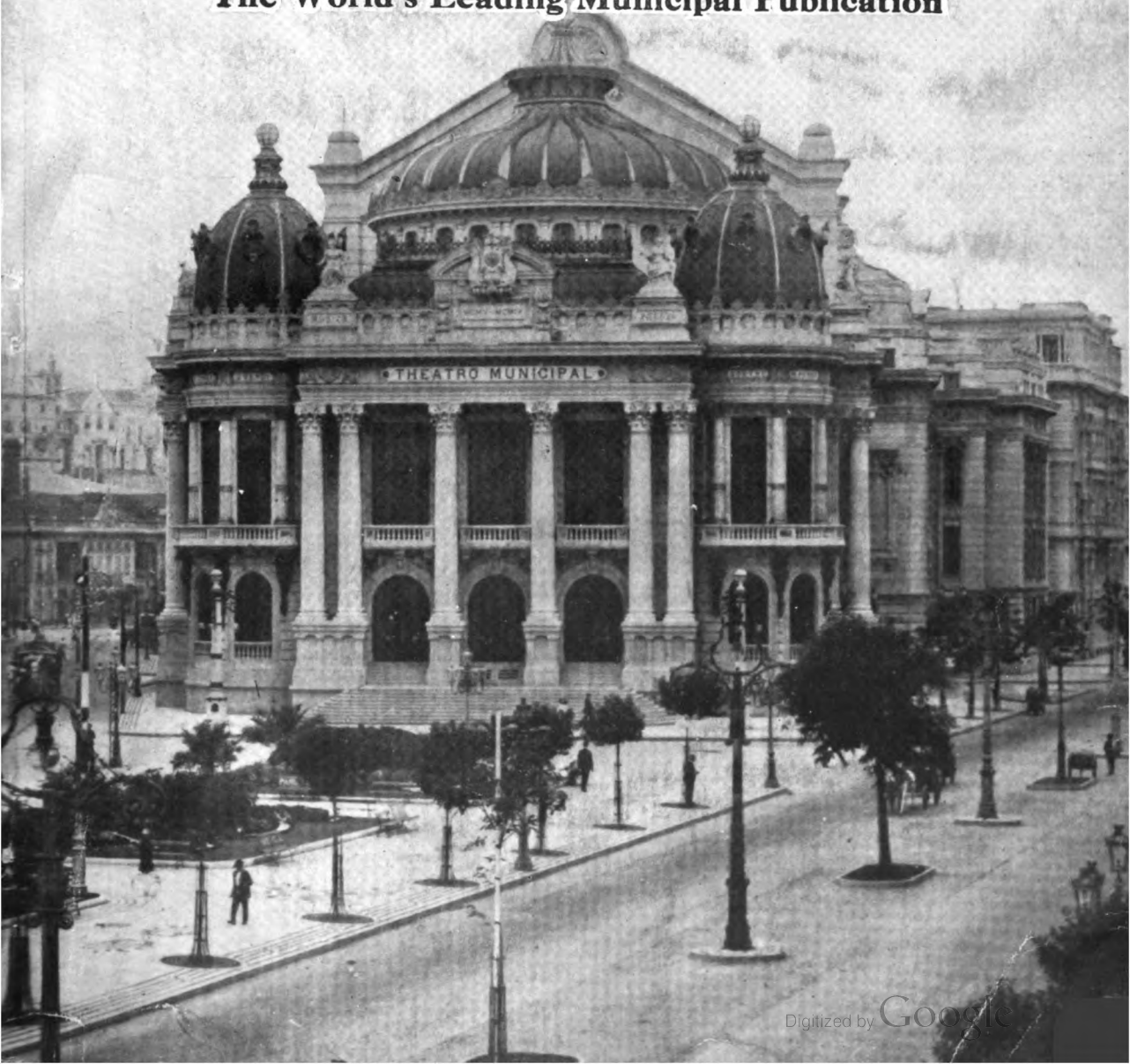

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Vertical Fiber Brick

26th St. - So. Omaha Neb.

ASPHALT FILLER USED

Standard Asphalt & Rubber Co.

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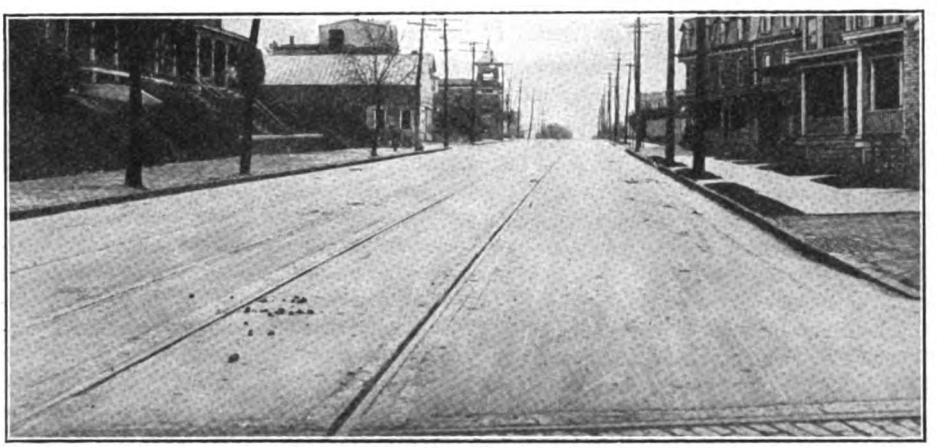

MARKET STREET, WILMINGTON, DEL. BITULITHIC PAVEMENT WITH STONE BETWEEN STREET RAILWAY TRACKS.

VOL. XLVIII. FEBRUARY, 1915. NO. 2.

Engineers are the votaries of an art which has for its object the furthering of things and methods that serve for the use and convenience of man. They should make that object the aim of the direct tendency of their work and the criterion of its fitness for the exercise of their energies.—Clemens Herschel.

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STREET LIGHTING PRACTICE

WITH INCANDESCENT LAMPS

By G. H. Stickney, Harrison, N. J.

This carefully prepared discussion of the use of modern incandescent lamps in street lighting is by an expert who is familiar with all the problems arising in connection with the installation of a system of electric street lighting. It is part of a paper prepared for the American Society of Municipal Improvements and lays down the principles which have been developed, the illustrations giving examples of some details of installations.

IN the lighting of a modern American city, one encounters a range of practice varying, step by step, from the dim lighting in the outlying districts to the brilliant lighting of the main central thorofares. This typifies, in a way, the historical progress of the art from the time the best street lighting consisted merely of beacons to guide the travelers, up to the present standard of ornamental street lighting. Nor has the practice shown an indication of having reached an ultimate standard. On the contrary, the rate of advance at the present time seems to be more rapid than ever before. Never has the value of good street illumination been so highly appreciated, while the recent improvements in illuminants, tending toward the economical production and utilization of light, seem likely to result in raising the standard rather than in reducing the cost to any great extent.

The history of street lighting indicates that better lighting follows closely on the availability of improved illuminants. As an example of this, we may note the advances which followed when the open arc became available about 1878; the enclosed arc about 1895; the luminous arc about 1904, and the tungsten filament incandescent lamp about 1907.

Purpose.—While the purpose of street lighting has been discussed frequently, it is desirable that we have clearly in mind the purpose of the illumination.

For ordinary or utility street lighting, the main purpose is to permit the traveler to pursue his way with safety and convenience. In outlying roads, the lighting may serve merely as a guide to enable the traveler to keep on the road. In city lighting, it is important that one be enabled to avoid irregularities in the street, as well as collision with others. Where the density of traffic is greater, the danger of collision is correspondingly increased, and hence clear and quick vision is more necessary.

Nowadays, thanks to the extension of street lighting, we hear less about the value of street lighting as a protection against persons of evil intent—robbers, highwaymen, etc. Yet we must not overlook the importance of street lighting in the preservation of peace. The extension of good lighting into sections of a city which are subject to disorder, is one of the most effective means of eliminating the evil.

Beyond all this, however, there is another purpose for street lighting, which has developed rapidly in the past decade, and has demanded for certain sections of a city an intensity of illumination which often considerably exceeds that required for safety. The new element of such lighting is the endeavor often made, at considerable expenditure, to render the street more pleasing and attractive. This is the motive of the so-called ornamental or whiteway lighting.

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Owing to the influence of the ornamental lighting, this purpose is also now felt to a greater or less degree in ordinary street lighting.

Illumination Effects.—The practice as regards illumination effects may be considered from several distinct standpoints. It is useful to classify the practice, however, with regard to the extent and nature of the illumination, as follows:

(1) Beacon lighting;
(2) Uneven illumination;
(3) Even illumination.

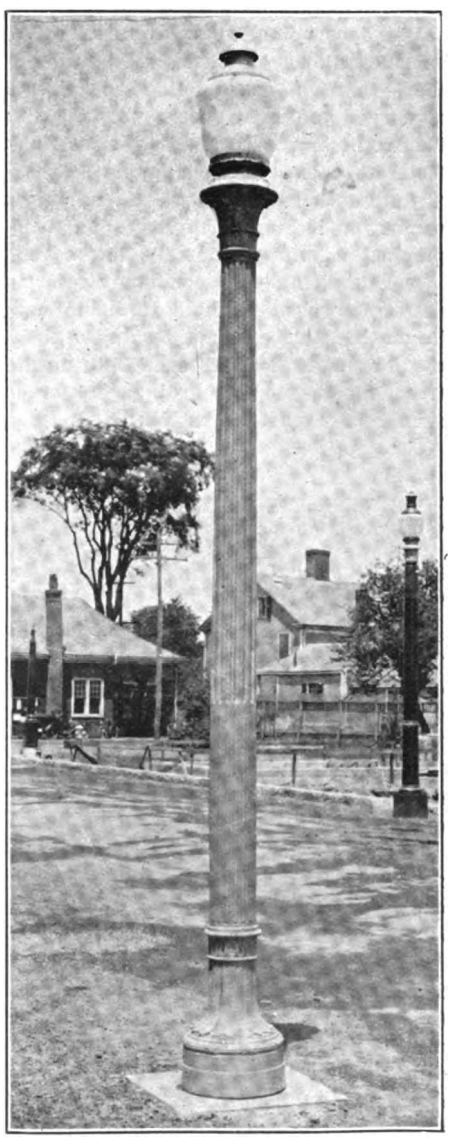
Beacon Lighting.—This character of lighting has already been mentioned. Practically no illumination falls on the roadway, the low intensity lights serving, by their location, to indicate the course of the road, much as a lighthouse and beacons at sea guide the navigators. Such lighting is, of course, inadequate for city streets, but for rural roads, where questions of cost may prohibit the adoption of a higher standard, such lighting will add considerably to the safety of travel; and for such conditions the extension of even this low intensity lighting will be beneficial in developing the country.

Uneven Illumination.—This refers to the practice often observed where areas of streets, near the lamps, are illuminated to a fair intensity, while the intervening sections are but slightly illuminated, and may, in contrast to the illuminated portions, appear to be in absolute darkness. The practice originated thru the early use of arc lamps, especially the open carbon arcs, which, for economy, were spaced at wide intervals—usually at street intersections. At first thought this practice may seem to be entirely unjustified, except on account of the peculiarities of the illuminants, which, in the case mentioned, were inherently of relatively high power.

However, there has been much discussion and difference of opinion on this subject on the part of students of street lighting practice. For certain conditions there seems to be more reason for the practice than would appear on superficial consideration.

Where the intensity of street illumination is very low, large objects, vehicles, etc., are seen in silhouette—usually as dark outlines against an illuminated street surface. Under such conditions experience has shown that such objects can be seen at a much greater distance by the uneven illumination, than if the same total amount of light were evenly distributed.

ORNAMENTAL POLE *top equipment for high-power series Mazda lamps. Three slightly different designs of poles are shown, of various degrees of attractiveness by day and by night.*



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Since high power units, widely spaced, cost less per mile of street than low power units at correspondingly narrower intervals, it often happens, where the cost of street lighting must be minimized, that this is the most practicable method of lighting. By locating the light sources over the street at points of street intersections, where the greatest danger of collisions exist, this method is likely to meet the needs of the drivers of vehicles, especially swift-moving automobiles, altho the glare may be objectionable.

The weakest point of this method is that it does not serve the pedestrian on the sidewalk advantageously. Especially where there is dense foliage, or streets are curved and narrow, it is not effective. Where there are irregular intersections of streets, some crossings cannot be properly illuminated without a narrower spacing of lights which may offset the principal advantage, namely, low cost.

Even Lighting.—We commonly refer to a street as evenly lighted if the intensities on the surface do not vary more than, say 10 or 15 to 1. With such lighting the street appears to the ordinary observer to have an even illumination.

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¶ LOW INTENSITY OF LIGHT, *with lamps closer together, produces better appearance of street and more even illumination, and is the more satisfactory for the pedestrian.*

The appearance of the street is very greatly improved with such lighting in contrast to the spotted illumination discussed previously. With higher intensity illumination, it is possible to see better than with corresponding uneven illumination; moreover, the cost is not likely to be much greater.

Classes of Streets.—While street lighting, as already mentioned, is graded by steps from the business center toward the suburbs, it is evident that it is not practicable to have too many steps, lest the lighting system become too complicated

This problem can best be studied by classifying the streets or sections of streets in a small number of groups having similar requirements; and reviewing their needs. Such classification would, of course, vary for different types of cities; for example, it is apparent that street lighting in Manhattan Boro would not typically represent an average American city; and that manufacturing cities would not exactly correspond to residential cities. However, our purposes can be sufficiently served by the following general classification:

(1) Principal business streets;
(2) Ordinary business streets and thorofares;
(3) Residential streets and parkways;
(4) Outlying streets, newly developed sections;
(5) Rural streets and interurban highways.

Whiteway lighting of the principal business streets demands not only the highest intensity of illumination, but diffusion and evenness. The tendency is to provide the maximum illumination opposite the buildings rather than at the street intersections. This is especially true when the lighting is promoted by merchants for advertising purposes. It is, however, good practice, since the illumination on the building front plays an important part in rendering the street attractive; while the illumination at the corners is almost certain to be sufficient for all purposes. Further, since most of this class of lighting employs ornamental lamp posts along the curb, it is often desirable to avoid placing lights at the street corner, as the glare from such a lamp in the eyes of a vehicle driver, who is about to turn a corner and wishes to see beyond, is likely to be more objectionable than the increased light is advantageous.

That the illumination of the building fronts contributes considerably to the cheerful appearance of the street, is evident from the gloomy appearance when

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are in blocks and foliage absent, should differ in treatment from the principal streets only in the degree of intensity and ornamental effect. The lighting units should be so arranged as to provide ample intensity at street intersections.

In the usual residence streets and parkways, where foliage abounds and the border of building fronts is absent, upward lighting is of little value. The degree of illumination required depends upon the amount of travel. The decorative value of the fixtures should, as far as practicable, correspond to the character of the street. As a rule, lights must be placed low to avoid tree shadows. Hence, a fairly frequent spacing with low power lamps is required. Where foliage be absent, wider spacing and larger units are practicable and often more economical.

For outlying and newly developed sections, which are likely to develop as residence sections, it is well to provide a spacing corresponding to the residential sections, securing economy by the use of low power lamps and arranging for effective distribution, even if some glare is present. This will permit changing readily as the demand for better illumination develops.

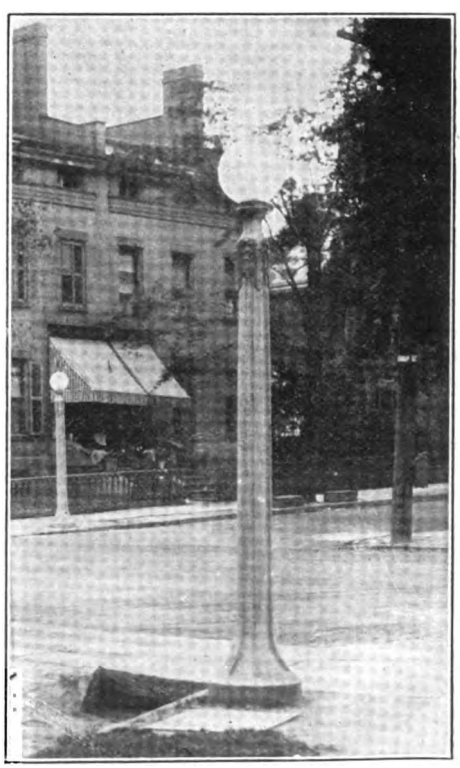
As we have already noted, the physical character of the street has a very decided bearing in determining the design of the lighting system. The width of the street should have a considerable influence in determining the height, spacing and arrangement of lighting units.

A factor which is often overlooked is the color of the street surface. A dark surface demands much more light for effective seeing than a light one. The oiling of streets, which were formerly a light colored macadam, has been a frequent source of complaint of the street lighting, tho the cause of the deficiency has often been overlooked. It can hardly be expected that streets will always be finished to suit the street lighting, but since the color has so decided an effect on the illumination, the lighting should be considered in this connection.

The variety of factors entering into the problems of street lighting render it necessary to make many compromises. The desirability of unity of design thruout a city, should not be overlooked, especially in the lighting of a long thorofare, which may extend from a business center to the outskirts. In such a case it may be necessary to sacrifice the peculiar requirements of a particular section to the production of an effective whole. It is usually practicable to grade the illumination by using lower power units of similar design, or by using wider spacing, away from the center. In case more than one light source per pole is provided, it is some times advisable to secure this result by varying the number of lights per pole.

Arrangements of Lights.—Quite a variety of arrangements of lighting units is in vogue, but the recent installations show a marked tendency toward the use of poles along the curb line, with lamps upright at the top of the pole, or hung

BALL GLOBE *pole top equipment for low-power Mazda lamp used in Rochester, N. Y., with concrete pole.*



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pendent at the end of a short arm or ornamental neck. Especially in those cases where attractive appearance is considered important, the pole top unit predominates. See Figures 7, 9 and 10.

In the early installations of large units, it was the common practice to suspend the lamp over the middle of the street. This arrangement undoubtedly is generally the one which provides for the most economical distribution of light and is advantageous for producing the silhouette effect. On the other hand, this position, unless the lamps are hung very high, gives maximum glare in the eyes of a driver; while the overhead construction is rather unsightly in the day time. Long arm suspensions on curb poles are frequently advantageous, especially where foliage is present, but here again glare at night and unsightly appearance in day time, are likely to be encountered.

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¶ CLUSTER LIGHTS, *recently so popular, are wasteful of light because of ineffective distribution. Large size tungsten lamps have made simpler and more effective designs possible.*

When tungsten filament incandescent lamps were available only in small sizes, it became the practice, especially in ornamental lighting, to group four or five, and sometimes more, lamps in individual round globes at the pole top. The effect, particularly of the individual pole, was very attractive. Probably no other type of lighting units ever enjoyed as wide popularity or secured as rapid application. It was well known among engineers that, on account of the loss of light by ineffective distribution, as well as the interference of absorbing surfaces, this scheme of lighting was wasteful of light. When larger size tungsten lamps became available, with their higher efficiency and gradually giving way to these simpler designs.

Pendent units can be made to present a neat appearance in the street, and have the advantage of usually providing a more economical distribution of light, especially in the residence districts, where the upward light can be cut off by reflectors and utilized. See two cuts on following pages.

There is considerable difference of opinion as to the relative advantages of placing poles opposite, staggering alternately from one side of the street to the other, and arranging them along one side of the street only. The opposite arrangement makes the best appearance and, on wide streets, gives fairly even lighting with proper spacing.

On narrower streets, especially with wide spacing, the staggered arrangement gives a better distribution of illumination. With very low intensity lighting, particularly on curved roadways, as in parks, the staggered arrangement should be avoided; it has some times led drivers to run off the roadway, and where dangerous obstructions occurred at the roadside, this has resulted in serious accidents.

The arrangement of poles on one side of a narrow street is often very effective and economical, and is especially applicable to the lighting of parkways, and suburban or residence streets. This arrangement is not likely, however, to meet with favor in commercial streets, as it tends to draw pedestrians to one side of the street, to the disadvantage of stores on the other side.

On boulevards and wide streets, having grass plots in the center, it is often advantageous to locate lamp poles down the center, or, in some cases, to combine this arrangement in various ways, with lines along the curbs.

In some cities small incandescent lamps

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occasion, rather than for permanent lighting.

Height and Spacing of Lamps.—It is impracticable to give an accurate rule for determining height and spacing, but the following comments, based on the practice, should be helpful.

The spacing of lamps differs for various arrangements of poles, as well as for the power of unit and intensity of the illumination required. The height and spacing are interdependent and each should be determined with relation to the other, allowance being made for the characteristic distribution of light from the lamp employed.

Too frequent spacing of lamps should be avoided to prevent cluttering the street with poles. This, however, is an unusual fault, since economy usually tends to dictate too wide a spacing for the most effective lighting. In business districts, the spacing between pairs of opposite poles, or along the street between staggered poles, generally runs between 60 and 120 feet. In residence districts the spacing is a little wider, say, 100 to 200 feet. In older installations, spacing as wide as 400 feet is not uncommon; but with the range of sizes of lighting units now available, it is seldom good practice to space lamps further than indicated above, except for the so-called beacon lighting. The tendency is toward narrower spacing, using smaller power lamps, if necessary, to secure economy. Except as mentioned elsewhere with regard to ornamental street lighting, it is advantageous to provide at least one lamp at each street intersection, and the spacing should be planned with this in view. Where blocks along a street vary in length, spacing for different blocks can be slightly modified from the average, to equalize the intervals for each block.

In planning locations, it is some times found advantageous to indicate lights by means of small weights on a plan of the section to be lighted, and thus trying the different possible arrangements and spacings until the best one is obtained.

more uniform, such comparisons were often made in watts per running foot of street, but at the present time mean spherical candle power per foot, or lu-

TWO-LIGHT *ornamental pole with pendent fixtures for Mazda lamps, in use in Hartford, Conn., presents an attractive appearance and is especially suitable for the conditions. Note the distribution of the poles down the street within the view.*

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mens per foot, will be more reliable. A more accurate measure, especially for high intensity lighting, would be in terms of the average foot candles of intensity on the street surface. This involves a more laborious calculation, based on particular arrangement of units and reference to photometric curves, and is not ordinarily justified.

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¶ THE NEW TESTS *are determining brightness of the illuminated surface as well as intensity of illumination, and will make it easier to fit the lamps to the kind of work to be done.*

In the very complete tests being run under the auspices of the National Electric Light Association and the Association of Edison Illuminating Companies (Report of Street Lighting Committee, N. E. L. A., 1914.), both the intensity of the illumination falling on the street and the brightness of the surface have been measured; and it is to be hoped that the data accumulated will furnish a more complete guide for the interpretation of street illumination values.

It is evident that lamps hung over the street need be higher than if located along the side. The general tendency is to place lamps too low. High power lamps and those having high intrinsic brilliancy need to be placed higher than low power lamps, or lamps with light diffusing equipment. Also, lamps which emit a larger proportion of light downward should be hung higher than those which distribute the light at wide angles.

For high power lamps, hung in the center of the street, the height in practice runs from 20 to 35 feet, or even higher. It is seldom advantageous to hang such lamps less than 25 feet above the ground.

High power pendent lamps, along the curb, are usually from 18 to 25 feet from the ground, but pole top lamps with diffusing globes are often placed as low as 14½ feet. Small units along the curb run from 10 to 16 feet.

Intensity.—Intensity is the measure of the brightness of a light source or of the illumination falling on a surface.

The intensity of a light source is measured in candle power. The candlepower of most units varies for different directions, altho for nearly all types the distribution is symmetrical with regard to the points of the compass. Some sources do not give a steady light, so that the candle power varies from instant to instant.

The candle power of a lamp is subject to depreciation with time, due to various causes, such as shrinkage of the light source, depreciation of luminous material, accumulation of deposits on the surrounding glass (products of combustion, or evaporation peculiar to the illuminant), or to dust and dirt.

Thus, we see that candle power is a very indefinite term and, unless we specify other conditions, does not represent an accurate value. In the case of incandescent electric lamps or gas mantles, it has become the practice to rate in terms of mean horizontal candle power, i. e., average candle power given in a horizontal direction, with new lamps and test conditions. Hence, this value is understood when nothing else is specified. Otherwise, it is necessary to qualify the candle power, defining it with one or more of the following qualifications: Initial candle power, average candle power thruout life or trim, maximum candle power, minimum candle power, candle power at a specified angle of elevation, mean spherical candle power, mean (lower) hemispherical candle power, mean horizontal candle power, mean candle power from 0 to 60 degrees, etc.

When we have the mean spherical candle power, or mean candle power, in any zone, we may determine the flux of light in lumens, by multiplying by the solid angle corresponding.

For example: The total lumens emitted by a light source is equal to the mean spherical candle power times 12.57.

The lumen, being a newer unit and less familiar to the laymen than the candle power, is sometimes looked upon with suspicion and disfavor. In reality it is more definite than candle power, unless the latter is elaborately explained. Since the unqualified lumen is the highest value obtainable, it is less liable to be used to

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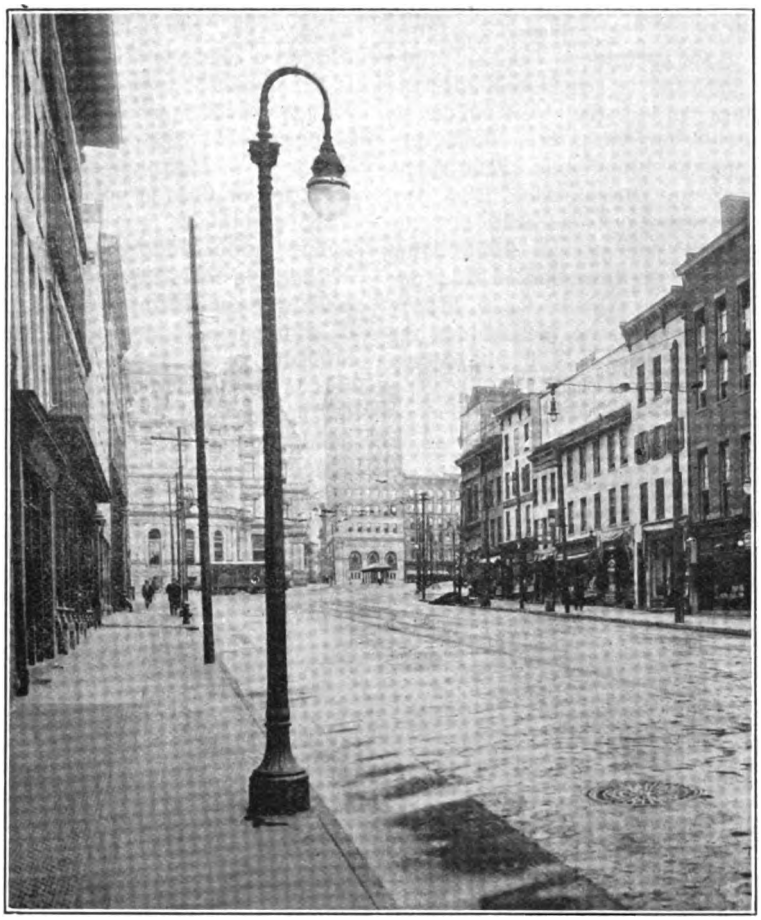

SINGLE-LIGHT *ornamental pole and pendent fixtures in use in Hartford, Conn., on the narrower business streets and to extend the lighting on principal wide streets away from the business center. Note the arc light on arm over street and the low ornamental light clusters in the background, showing that no complete design has yet been installed.*

deceive, either thru ignorance or intent.

Intensity of illumination falling on the street is measured in foot candles (in scientific circles some times called meter candles). This may refer to the intensity on the horizontal surface of the street, on a plane normal to the light rays, or a vertical plane. Measurements of either horizontal or normal foot candles, for particular points in the street, are made by means of portable or illumination photometers. Recently measurements of average brightness of street surface have also been made.

With regard to the horizontal and normal intensities, there is some difference of opinion among lighting experts as to which is the most correct measure of the value of the illumination. The horizontal foot candles measure the illumination falling on the flat surface; the normal foot candles, the brightest illumination on an ordinary obstruction. For high intensity it is common practice to use the horizontal value, while for low intensity lighting, especially with wide spacing, the tendency is toward the use of the normal.

Under the latter condition it is often very difficult to make horizontal measure-

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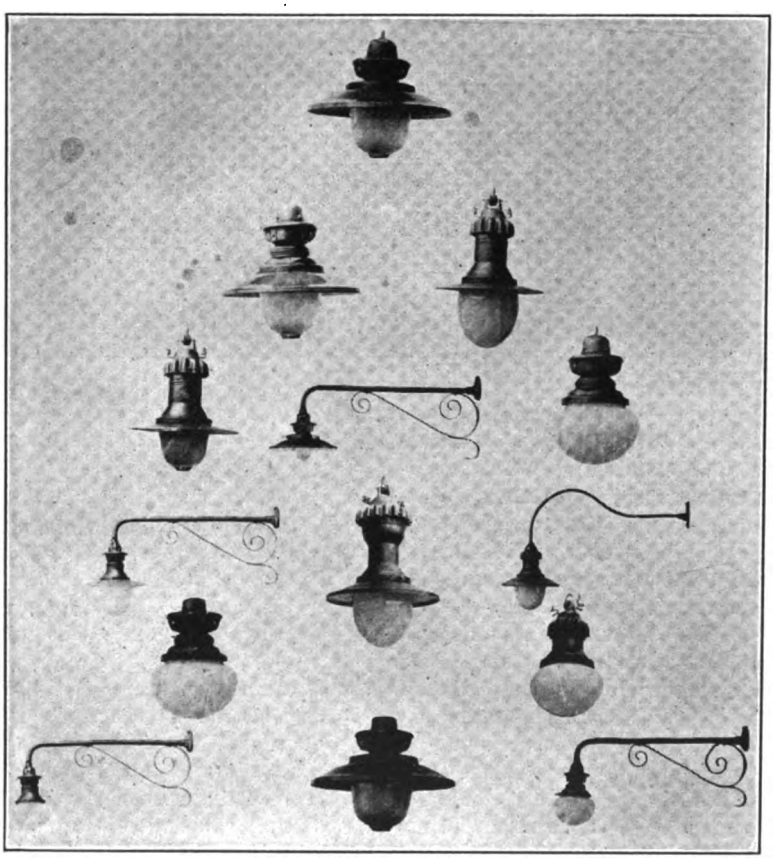
ments; moreover, it is generally conceded that the normal values give a fairer measure of the usefulness. The two values cannot, usually, be compared directly. Both values can be calculated from candle power curves, for points at a known distance from the illuminants. The calculated horizontal illumination from two or more sources may be added to give the total intensity, but normal illumination represents only the illumination from one lamp.

Since each calculation determines the intensity at one point only, it will be seen that considerable calculation would be necessary to determine the illumination thruout a representative section of street. It is common to give the values at representative points, as, along the center line, halfway between lamps, directly beneath lamps, or to plot curves showing rate of variation or lines of equal intensity.

By dividing a section of street into squares and assuming that the horizontal intensity in the center of each square represents the mean intensity of the square, it is possible to determine the average intensity on the street surface.

It is possible to figure from the above the flux of light over a section of street (foot candles times square feet, equals lumens), but it is more common to figure the illumination in terms of intensity.



GROUP OF PENDENT FIXTURES *for Mazda street-lighting lamps, showing some of the varieties of style available.*

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A MODERN FRANCHISE

FOR A PUBLIC SERVICE CORPORATION

By Charles Carroll Brown, M. Am. Soc. C. E., Indianapolis, Ind.

This brief resume of a recent franchise granted by a small city shows what is easily possible in renewing an expiring franchise in securing terms more scientific in their nature than were contained in the old franchise which it replaces. Rates may be too high, but they are the best the city council could secure with their present lack of knowledge of all the facts. The future control is sufficient to bring rates to their proper level at the end of the first five-year period.

PERHAPS a better title for this paper would be "A Recent Franchise," etc., because the franchise in question is not in all respects modern. A discussion of it will be of interest mainly to show what may be obtained in the way of a new contract by a small city in a state in which there is no public service commission and no particular machinery for the control or regulation of public service corporations, when such a city wishes to renew a contract made years ago with a local organization which has since been absorbed by a great corporation owning many plants in various parts of the country.

The former franchise was one which left nearly everything in the hands of the company operating under the franchise, but fixed the rates so that they were not excessive under the former conditions. The term of the franchise was fixed and as it was about to expire the company offered new rates which were not well understood by the city authorities. They concluded that they needed expert advice and secured it. The contract includes both water and electric light service. With the advice of their experts and their suggestions of a form of contract they entered into negotiations with the company and after nearly a year of discussion they succeeded in working out a form of contract which is satisfactory to both parties. The city officials intrusted with the formation of the contract were competent business men and attorneys who were working for the best interests of the city. The resulting contract may be considered to be a fair sample, therefore, of what can be obtained by this method of negotiation, it being remembered that the experts were not called upon to pass upon the final form of the contract, their assignment having been completed when they presented their report of a form of contract which they would recommend and rates which they considered equitable for both parties. It might be mentioned that the new rates offered by the company appeared to the city officials to give a reduction in price of electric light to private consumers, but examination by the experts demonstrated that they would have resulted in a material increase in the monthly bills of users of the current. The city is held as anonymous, as discussion may be somewhat more freely made if its location is not known.

The new franchise is not modern in its first provision, since it provides that the franchise shall be sold to the highest bidder and that it shall not be sold for less than $500. This meant simply that the company should pay the city $500 for the privilege of remaining in business. The company must make this price out of its profits. The company is required to furnish, free of charge, water required to supply one public drinking fountain, one ornamental fountain, as described in the franchise, and 4,000 gallons a day for flushing sewer tanks to be operated by

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the company and maintained by them on the city sewer lines, also water for flushing streets and sidewalks and building them. The company is required to pay the city 2 per cent. a year of the gross receipts of operation, the city having the right to employ expert accountants to check up the reports of the company in case they are questioned. This payment must also be made out of the consumers and the rates must be large enough to cover it. The city is entitled as a corporation to a sum which will reimburse it for its necessary expenses on account of the presence of the pipes, wires, poles, etc., on and under the streets, and the construction of extensions thereof, and this 2 per cent. allows for this and it increases in total amount as the business of the company and presumably its burden on the streets increases, so that this payment would seem to be justified if the amount of it has been properly determined.

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¶ THE DETAILS OF APPARATUS *and methods of construction are given with sufficient fullness to enable the city to secure what it asks for in service and in improvement thereof from time to time.*

Definitions of terms and of notices are properly made and the company is required to keep an office open in the city during business hours. Its general duties of furnishing water and light service to city and citizens are clearly defined, and a few special details are prescribed.

The detail of methods of construction is set forth and is as full and modern as possible and still permit the continued use of the apparatus already constructed and in use, and need not be given except as to improvements provided for as shown later.

Interference with apparatus or use of the same by the city or other companies or persons already in the streets or allowed therein by the city is not permitted, and bond of the company to indemnify the city against any damage from this or any construction or maintenance operations is provided in the sum of $5,000.

The company is required to produce 100 pounds pressure on gages at plant and fire headquarters within five minutes after alarm and is carefully limited as to liability for fire loss in case this cannot be done on account of circumstances beyond its control.

¶ EXTENSIONS AND CHANGES *in existing details are provided for at expense of city or of company, as was deemed equitable by council and company.*

Permits for excavations must be procured by the company from the city and work constructed without such permits can be ordered out by the council. In case the city wishes poles relocated the company pays for the first relocation and the city pays for subsequent relocations. Provision is not made for relocation or lowering water mains with change of grade.

The city can use the company's poles for fire alarm wires, but must indemnify the company for any loss or damage on account of such use.

The provisions for extensions are numerous. The city may increase the number of public hydrants and street lights at will and the company must put them in within sixty days or city will deduct $1 a day for each day until put into use. The city must add a hydrant for each 500 feet of water main extensions it orders and if extensions are less than 500 feet long the property owners must agree to take enough water to give the company an annual revenue of 8 cents per foot of main laid, the city's hydrant being put in later when the extension is again extended to make it 500 feet long. Extensions less than 200 feet long shall be made at request of property owner, provided he bonds himself to take and pay for water supplied him for at least five years. They must be made if more than 200 feet long if the property owner pays the whole cost of the extension, but he will not be required to pay any water rent until his bills for water furnished equal this cost, after which time he pays rental as other consumers. Connections to properties on lines of mains shall be made on request,

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payment of $5 for making the connection complete to the curb or grass plot in front of property, and making contract for water at price not less than $5 a year. Extensions for electric service less than 350 feet long shall be made on request, and if more than 350 feet long on payment of the cost of the excess over 350 feet. Thirty, sixty and ninety days' time are allowed the company for the work of making house connections, short and long extensions respectively.

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¶ RULES, *regulations, kind of service, are provided for, and penalties for violations or failures by company, city and private consumers are imposed*

The company can make necessary rules and regulations, subject to approval of council, and council will pass ordinances approving them, preventing pollution of water and injuries to property. Rules, regulations and rates must be applied to all consumers without discrimination. Violations of rules or non-payment of bills subject consumer to shut off, and such delinquent consumer must pay 50 cents in addition to the bill before service will be turned on. This provision does not state definitely what will happen in case the consumer moves away leaving an unpaid bill, or the property changes hands and the seller leaves an unpaid bill. Failure to furnish service for thirty days subjects the company to forfeiture of franchise, and for less time to forfeiture of double the rates for city service for the time the failure extends. Private consumers on meter rates pay actual service and minimum rate does not apply in such case. Deductions are made for single hydrants or lights out of service at double the contract rates if out of service more than three days, or at schedule rates for less time. Service is defined for hydrants as in good working order and constantly supplied with water; and for street lights as burning from one-half hour after sunset until one hour before sunrise. The question of whether failure to supply the service is unavoidable or the fault of the company may be referred to the board of arbitration provided later, in case of disagreement. Responsibility for reporting hydrants and lights out of order is put on the chief of police.

The city's bills for service rendered are paid in city warrants due six months from date, with 6 per cent. interest, and may be paid at any time before they are due.

Complaints as to justice of action of the company regarding granting or refusing service can be referred to the council, whose action is final.

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¶ RATES *for city service and for private consumers for water and light are given in full and are in general conformity with rates in other small cities under similar conditions.*

Rates for city service are as follows: Hydrants, $42.50 for each of first 65, and $40.00 for each additional; water for city purposes, except the free water above noted, 10 cents per 1,000 gallons; hydrants to be maintained by company and used by city for fire purposes and for flushing streets and mains and for building and repairing streets; damage to hydrants by fault or negligence of city employes to be paid for by city. For street lights, $70.00 each for first 46 6.6 amp. enclosed A. C. 500-watt lamps, and $60.00 for additional; $19.00 for 40-c.p. tungstens, $24.00 for 60-c.p., $32.00 for 80-c.p. $40.00 for 100-c.p., lamps to be maintained by company; light in city buildings at 3 cents per kw.hr., including school buildings, meters and connections furnished by company.

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¶ NEW AND MODERN STREET LAMPS *are provided for, also a meter for determining amount of current used, tho lamps are paid for at flat rates.*

New street lamps are to be 500-watt or more A. C. enclosed arcs, incandescent tungstens or their equal. City locates lamps and may change from arc to tungsten or the reverse without charge. Changes in location of old lamps made within ninety days of making of contract are without charge, but those made later

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are at charge of city. When changes of types of lamps are made the city may raise the question of rates for new lamps and if parties cannot agree, the question may be referred to the arbitration board later provided for.

When the city requires, a specified ammeter will be installed to measure the current used in street lighting, to be paid for and operated at equal cost of city and company.

Water rates for private consumers for quantities used per month named are as follows: 1,000 to 20,000 gallons, 30 cents per 1,000; 20,000 to 40,000, 25 cents; 40,000 to 60,000, 20 cents; 60,000 to 80,000, 15 cents; 80,000 to 100;000, 10 cents; over 100,000 gallons, special; with a minimum of 50 cents a month from October 1 to March 1, and $1.50 from April 1 to September 30. Meters must be installed on all service within nine months, provided that not more than twenty-five meter installations per month can be demanded. All meters must be kept in good, accurate running order. Flat rates are provided to be used until the meters are installed, the number of flat rate consumers being reduced rapidly. Discount of 10 per cent. is made from bills if paid before 10th of month, but bill cannot be made less than the minimum above.

¶ AN ARBITRATION BOARD *for fixing rates and settling other possible contests over certain provisions is provided for in case city and company cannot agree at end of five-year period or other date of proposed changes.*

Electric power and heating rates to private consumers are subject to special contract; lighting rates are as follows: 0 to 30 kw.hr. (presumably used per month), 12 cents per kw.hr.; 30 to 60, 10 cents; 60 to 150, 7 cents; 150 to 200, 6 cents; 300 to 1,000, 5½ cents; over 1,000 kw.hr., special; subject to 10 per cent. discount if paid before 10th of month. Meters must be furnished and kept up by the company and tested free of charge at request of customer.

The rates for public and private service quoted above are fixed as the maximum for five years, and are then subject to change by agreement.

If the city and company cannot agree upon the new rates a method of arbitration is provided, which has already been in successful use in another small city under similar conditions. It is as follows: "At no time during the term of said franchise shall the maximum rates to be charged said city or its inhabitants for water or electric current be higher than the maximum rates herein fixed. If the city and the grantee shall be unable to agree upon the revision of rates herein provided for, such rates shall be fixed for said five year period, in the first instance by any state body created by law for such purpose; or, in the absence of such state board, such rates shall be fixed for said period by a board of arbitration of three wholly disinterested and competent engineers, none of whom shall be employed by or connected with the grantee or the city, to be organized as follows: One member shall be selected by the city and one member by the grantee, and these two members so selected shall select the third member. In the event the city or the grantee shall fail or refuse to select a member of said board of arbitration, or the two members of said board selected by the city and the grantee shall fail to select the third member of said board, either said city or said grantee may apply to the judge of the circuit court, asking said judge to select a member of said board to fill such vacancy therein, and the member of said board selected by said judge shall have full power to act with the other members thereof." Some details of procedure are included. One significant addition to the above provision, which has been worked out by the company, reads: "On all questions, except as to rates, such board of arbitration shall be three disinterested, competent persons." In the light of some experience of the writer in securing a disinterested, competent board under a provision similar to the above, except as to the last sentence quoted, this sentence indicates the intention of the company to have its member of the board an advocate of its side of the case.

In proceeding for determining rates the

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board is not to take into consideration any value of the franchise, except so far as the 2 per.cent. of gross expenses, which is paid to the city, may be so considered.

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¶ CONSTRUCTION OF A WATER FILTER *under approval of city and of State Board of Health is prescribed.*

A special provision in this franchise gives the company a year to begin the construction of a filter for the water supply and six months more in which to complete it and put it in operation. Due penalties for failure to perform these duties are provided, also for failure to operate the filter satisfactorily. Plans and specifications for the filter plant must be approved by the city and by the state board of health. If the company fails to supply water satisfactory to the state board of health for any five days, after the filter is in full operation, the company must pay a fine of $5.00 a day for up to ten days; $10 a day up to fifteen days; $20 a day up to thirty days, when the franchise will be forfeited unless the failure is due to circumstances beyond the company's control, in the opinion of a board of arbitration appointed as above. In case the board decides in favor of the company, it shall still pay the $20 a day fine for such time as the quality of water is below the state board of health standard, and such other damage as the city may prove itself to have sustained on account of such impure water, or that its inhabitants have sustained. At any time the city is dissatisfied with its water supply as to quality, it can call in the state board of health and if that board so decides, the company must bring its water supply up to standard within thirty days or forfeit its franchise, unless the failure is not on account of its own negligence, such question to be decided by the board of arbitration. The state board of health must approve of any new system or source of water supply. These provisions leave the company free to take water from any source it desires, provided it can bring such water up to the requirements of the state board of health, and at the same time enables the city to enforce the supply of a sanitary, safe and palatable supply. The application of these provisions is suspended for the eighteen months until the filter plant is in operation.

The rates may be considered rather high, but it must be remembered that they can not be raised during the term of the franchise, but may be lowered at any five year period. It should also be noted that the city has at the present time no information as to the operations of the company, but, by the terms of this contract will have considerable information, as well as the aid of the board of arbitration, at the ends of the five year periods, tho the board will not have as much opportunity to secure the necessary knowledge in detail as it should, since the company has prevented the insertion of a clause giving the board of arbitration the right to examine the books of the company, and the city has not reserved any such right, except as to the gross proceeds of operation.

The writer will not attempt at this time any extended comment on the provisions of this franchise. They speak for themselves. He will only call attention to the safeguarding of the quality of service, both water and electricity; the revision of rates at the option of either party at intervals not too great and by an expert board; the control of sanitation by the state board of health. With the exception of one or two details concerning which the company has not agreed with the consulting engineers of the city, it is believed that these controls are as safe as they can be in a state without a well-established, competent public service commission. Rates may be too high to begin with, but they are subject to reduction at the end of five years. It should be remembered, also, that some of the controls assumed cost money, and that the company must make a material addition to its plant to provide the better water supply demanded. It is also a fact that the city was not objecting to the rates in force, but its demands were almost entirely for pure water and plenty of it, and for modernizing to some extent the street lighting.

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TREATED WOOD BLOCK PAVEMENTS

THEIR HISTORY IN THE UNITED STATES

The history of treated wood block pavements in the United States covers a period of nearly twenty years, really beginning with an experience in Indianapolis with a modern untreated block pavement, laid with wood, slow to decay, but too soft for heavy traffic. It shows a rapid development in the use of this form of pavement, due to the excellent qualities it exhibits, and shows the many changes made in details of treatment and of construction which experience has brought about. This outline is from a report of a committee of the American Wood Preservers' Association.

THE first use of untreated wood blocks as a paving material in the United States is said to have been in a pavement laid in New York City about 1835. Before 1840 Boston and Philadelphia laid pavements of spruce and hemlock blocks, which cost from $2.00 to $2.50 per square yard. The use of untreated wood blocks for pavements was soon taken up by other cities and a large variety of species were employed, such as tamarack, Douglas fir, and redwood. Large amounts of round blocks, mostly cedar, were also used, especially thruout the Middle West.

In the early use of wood blocks considerable attention was given to the form of the blocks and a number of these were patented. The Nicholson block, patented in 1848, was extensively used between 1860 and 1870. These blocks were rectangular in shape and gave a much more even surface than many of the other forms used.

During the sixty years preceding the use of treated wood blocks many cities laid large quantities of wood pavements at great expense. These were satisfactory at first, but they soon decayed, and in a comparatively short time after laying they had to be removed. Subsequent to 1871 over 1,000,000 square yards of untreated wood block pavement were laid in the city of Washington, D. C., costing from $2 to $4.20 per square yard. Nearly 30 per cent. of this was removed six or seven years after it was laid, and by 1889 the last of the blocks had been removed. Similar trouble was experienced by other cities using untreated wood as a paving material.

In most of the early wood block pavements little care was taken in the selection of the wood used, or in protecting it from decay. Often the blocks were laid on a plank foundation, placed directly on the ground, or upon a sand base, thereby creating a favorable condition for decay.

While both wear and decay are the principal causes of the failure of wood block pavements, decay is by far the most destructive agency. After years of repeated failures attention was directed to the use of wood preservatives.

In 1882 to 1885, wood blocks treated by the Wellhouse process were laid in St. Louis on Pine and Oliver streets, and are said to have remained there until worn out by traffic. The blocks were treated by the St. Louis Wood Preserving Company and were guaranteed by the contractor for nine years.

One of the first treated wood block pavements was laid in Galveston, Texas, about 1874. A pavement of about 75,000 square yards of longleaf pine blocks was

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laid at this time and was in service until 1903, when it was removed. It is not thought that these blocks were given the same kind of treatment that is usually given at the present time. They were laid on a sand foundation, no concrete being used. Details of the treatment of these blocks are lacking.

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¶ THE FIRST EXTENSIVE USE *of modern creosoted wood block for pavements was begun in Indianapolis, which city still has some of the early streets in use after nearly twenty years.*

In 1896 Indianapolis laid a few streets with blocks of Washington red cedar. These blocks were thoroly dried and then placed for six hours in a bath of creosote, which was heated to a temperature of over 210 degrees F. The absorption was estimated to be about 3 pounds per cubic foot. No expansion joints were used and considerable trouble was experienced on account of swelling. These blocks are still in use and are said to be in a good state of preservation.

It was realized that the best results could not be obtained by dipping the blocks, and in 1898 the first pavement was laid in Indianapolis of blocks treated with creosote under pressure. Longleaf pine was used and was given a treatment of from 10 to 12 pounds per cubic foot. At this time no particular attention was given to the character of the oil. This pavement, altho now reported to be in bad condition, gave such good results that city engineers began to appreciate the possibilities of treated wood blocks.

The first wood block pavement used in the East was laid on Tremont street, Boston, in 1900. The blocks were treated by the creo-resinate process, in which a mixture composed of one-half creosote oil and one-half resin was used. The object of adding the resin was to render the blocks more resistant to the absorption of water and to assist in retaining the creosote oil [illegible] this wood. This pavement is still

Rush street bridge in Chicago was paved with creosoted longleaf yellow pine blocks and the other roadway with untreated blocks. This afforded a good test of wood pavement, as the traffic on this bridge was probably heavier than on any other street in Chicago. It was necessary to remove the untreated wood blocks at the end of three years, whereas the creosoted section was in good condition at the end of seven years and gave indications of good service for several years more. They were then taken up on account of the untreated plank foundation being decayed.

One of the first creosoted wood pavements in Chicago was a section of longleaf pine blocks laid in front of the Auditorium hotel in 1900.

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¶ THE LARGER CITIES *soon recognized the value of wood blocks for pavements and are using large quantities.*

The excellent satisfaction given by these treated pavements, which were largely experimental, resulted in a very rapid increase in the use of wood blocks thruout the country. The larger cities in particular recognized the merits of wood blocks for streets subjected to heavy traffic, as well as for residence streets. Wood pavements in Boston, New York, Chicago and other cities were installed under severe traffic conditions, where the relative durability could be compared with pavements of other materials on the same street. Many of the other types of pavements which were under similar traffic conditions failed, while wood block remained in good condition. The durability, noiselessness and other desirable features of treated wood blocks have been realized more particularly within the last five or six years.

At presently nearly thirty miles of the most heavily traveled streets in Manhattan Boro, New York, are paved with treated wood blocks. In 1912 New York laid

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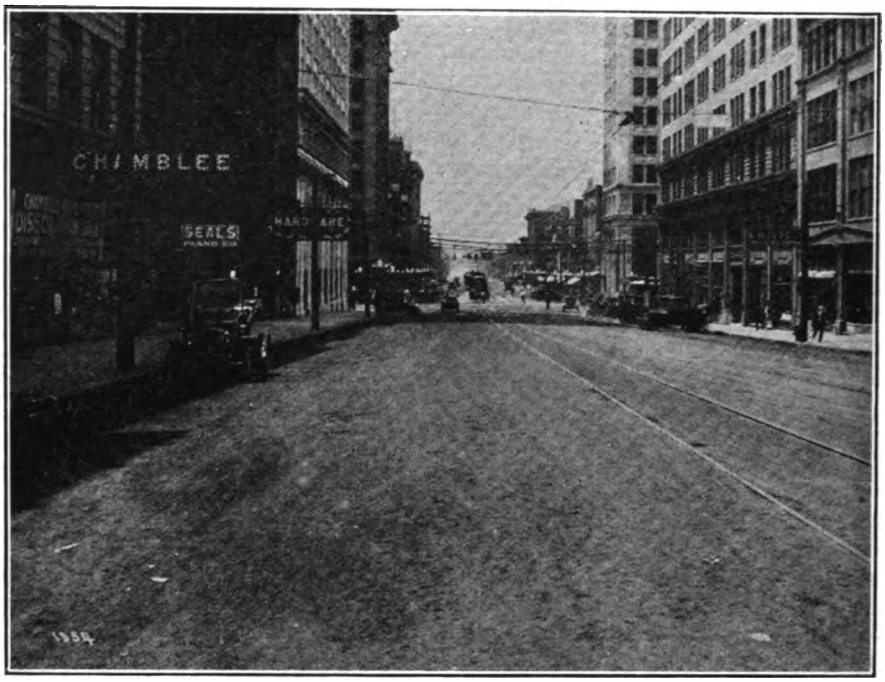

CREOSOTED WOOD BLOCK *pavement on First avenue, Birmingham, Ala.*

Minneapolis was one of the pioneer cities in the use of treated wood pavements, and has probably laid as much as any city in the country. The city already has over 1,000,000 square yards and expects to add about 175,000 square yards in 1914. By January 1, 1914, Detroit had over 458,000 square yards of treated wood pavement, having laid over 166,000 square yards of this in 1913. A number of other cities are also laying large amounts of wood block pavement each year.

Species of Wood.—Southern longleaf yellow pine was most used in the earlier treated wood pavements. This wood has been found by experience to give excellent satisfaction and is most largely used at the present time. Other species that have been used are tamarack, Douglas fir, hemlock, Norway pine, maple and black gum.

The species most generally admitted by various specifications comprise longleaf yellow pine, Norway pine and tamarack. Black gum has been used to some extent in the East, but it is claimed that this species has not been entirely satisfactory. Douglas fir is used to a considerable extent in the far West.

Tamarack has been used in several cities and has given good satisfaction. In order to obtain more complete knowledge on the relative value of the various species of wood for paving purposes, the United States Forest Service laid an experimental pavement in co-operation with the city of Minneapolis in 1906. The woods used in the experiment were creosoted longleaf pine, tamarack, Norway pine, western larch, white birch and hemlock. Longleaf pine was used as a basis of comparison for the other species. The last inspection was made July 15, 1914, eight years after the pavement was laid. From the results of this inspection the species may be classified in the order of their efficiency in this pavement in the following order:

1. Longleaf pine.
2. White birch.
3. Eastern hemlock, tamarack.
4. Norway pine.
5. Western larch.

Undoubtedly, there are a number of

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species of wood that would make satisfactory paving material, but on account of the incomplete knowledge of their value city engineers prefer a wood that has been tried and proved satisfactory. It seems probable that other species will in time be used more extensively than at present. The proper selection of the species of wood used for paving purposes is most important as it determines, to a large extent, the wearing qualities of the pavement.

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¶ DIMENSIONS OF BLOCKS *have varied from time to time and now vary according to use, economy and personal preferences of engineers.*

Depth of Blocks.—Recently there has been a tendency to reduce the depths of the blocks and at the present time 3½-inch blocks are frequently specified, and even 3-inch blocks.

New York City has adopted a 4½-inch deep block as standard in Manhattan, where it has been demonstrated that a 3½-inch block is not strong enough to withstand the heavy traffic. The Boro of Richmond (Staten Island) uses 3-inch block as standard. The Boro of Queens has some of the best wood-block pavement in this country and after nearly ten years' service 3-inch deep blocks show practically no wear. The traffic is plentiful, but the vehicles not very heavy.

The blocks used in the early pavements were generally 4 inches wide. In more recent practice the width has often been reduced to 3 inches. This prevents the blocks being laid on their sides. The permissible length varies from 5 or 6 inches to 10 inches.

Specifications generally require that the blocks shall be sound, free from large or loose knots, shakes and other defects of that nature. There are differences in the number of rings per inch specified and in the amount of sapwood that is permissible. Some engineers allow the use of blocks having five or six rings per inch and others specify not less than eight or nine.

The amount of sapwood allowed usually varies from 10 to 40 per cent. In the early use of treated wood blocks, specifications were more rigid in the requirement of a larger percentage of heartwood. Experience seems to indicate, however, that treated blocks having both sapwood and heartwood show no noticeable differences in wearing qualities from those without sapwood.

Preservatives.—The earlier wood paving blocks were treated with a light grade of creosote oil. Later, due largely to expansion difficulties, varying amounts of tar were added. The bleeding trouble has recently led some cities, notably Chicago, to specify a very high-boiling creosote free from tar. This oil has the disadvantage of being high in cost.

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¶ HEAVY OIL *for treating blocks is popular at the present time under carefully drawn specifications as to quality of oil and treatment.*

Most of the cities in the United States are now using an oil having a specific gravity of 1.10 to 1.14, and containing a large proportion of tar, usually required to be nearly free from carbon. Such an oil is also permitted in the specifications for paving oils of the representative societies interested in this subject.

There is little difference of opinion as to whether oil from water-gas tar should be used. It is claimed that this cheaper product might be mixed with coal-tar oils without lessening the value of the pavement. Several experimental pavements have been laid using this product, and until the results of these experiments become available most engineers prefer to exclude water-gas creosote from their specifications.

Method of Treatment.—The earlier pavements were treated usually with from 10 to 12 pounds per cubic foot of oil. Engineers then went to the opposite extreme, until it was the general practice to inject 20, and in some cases even 24 pounds per cubic foot, resulting in a greatly increased cost and excessive bleeding of the oil. Recently the tendency has been to reduce absorption, and at present 16 pounds per cubic foot is about the average used.

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The method of treatment first used was, in general, to subject the blocks to a dry heat of 250-280 degrees F., or to steam them at pressures varying from 25 to 50 pounds per square inch for periods varying from 3 to 4 hours, or more, depending upon the condition of the wood. A vacuum of 24 to 26 inches was then drawn to remove the moisture, after which the preservative was admitted without breaking the vacuum, and pressure applied until the desired absorption was obtained.

At present the method of treating the blocks is often left to the treating plant operators, the specifications merely requiring a given absorption. Some cities, however, outline the method of treatment in detail as to preliminary steaming, vacuum and pressure periods, giving the time, temperature, pressure, etc., for each operation.

Methods of Laying.—The old type of untreated block was generally laid either on a sand or a plank foundation, neither of which was satisfactory. Treated blocks were usually laid on a concrete foundation covered with a sand cushion, a method of laying which is still in quite general use. Much trouble has been experienced from the sand shifting or being washed from under the blocks, and thus producing an uneven surface in the pavement. Expansion troubles were also caused by water penetrating the spaces between the blocks and saturating the sand. A bituminous coating is now sometimes laid directly on the concrete base instead of the sand cushion.

While the sand cushion is still quite generally employed, there is a well marked tendency toward the use of a sand and cement mortar. This usually

CREOSOTED WOOD BLOCK *pavement in Americus, Ga.*

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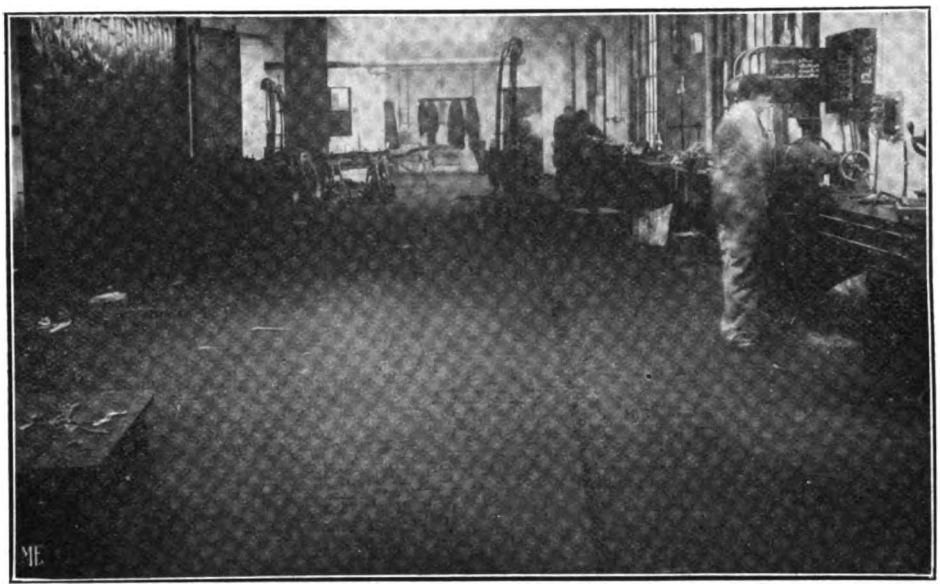

SHOP FLOOR *paved with creosoted wood blocks.*

consists of a mixture of one part cement to three or four parts of sand and is spread from ½ to 1 inch thick. This results in a more satisfactory pavement, especially under heavy traffic.

The foundation now generally adopted consists of a concrete base from 5 to 7 inches deep, depending upon traffic conditions, the mixtures commonly used being 1, 3, 5 or 1, 3, 6.

Joints.—In some of the early pavements laid no expansion joints were used, and in many cases no trouble has been experienced on account of swelling. In many other cases, however, much trouble has been caused through failure to properly provide for swelling of the blocks.

Streets on which the traffic is heavy do not require as much provision for expansion as do streets of medium or light traffic. In the Brooklyn and Manhattan pavements no provision is made for expansion. For a street 30 to 40 feet wide the expansion joints are usually ¾ to 1 inch wide and filled with bituminous filler. In most cities no joints are employed to take care of expansion lengthwise with the street.

The angle of courses is a point upon which engineers are not agreed. The most common method of laying has been at 90 degrees with the curb, but many of the streets are now paved with the courses at oblique angle. In the Minneapolis experimental pavement the blocks laid at oblique angle did not wear as fast as those laid at 90 degrees, since traffic was not directly across the joints of the pavement. Another advantage of the oblique angle of laying is that longitudinal expansion joints at the curb will take care of expansion in both transverse and longitudinal directions.

Filler and Top Dressing.—A bituminous or pitch filler was commonly used in the early treated wood block pavements. Bituminous or asphaltic fillers and also sand and cement fillers are the materials generally used at the present time for filling the joints. The advocates of the sand filler maintain that the sand fills the joints completely and that the surface of the pavement becomes practically homogeneous. It is claimed that a waterproof joint is formed by the sand absorbing the oil which exudes from the blocks. Others argue that the sand packs into the joints, thereby making an unyielding filler which does not allow expansion, but permits water to enter between the blocks, causing expansion of the pavement.

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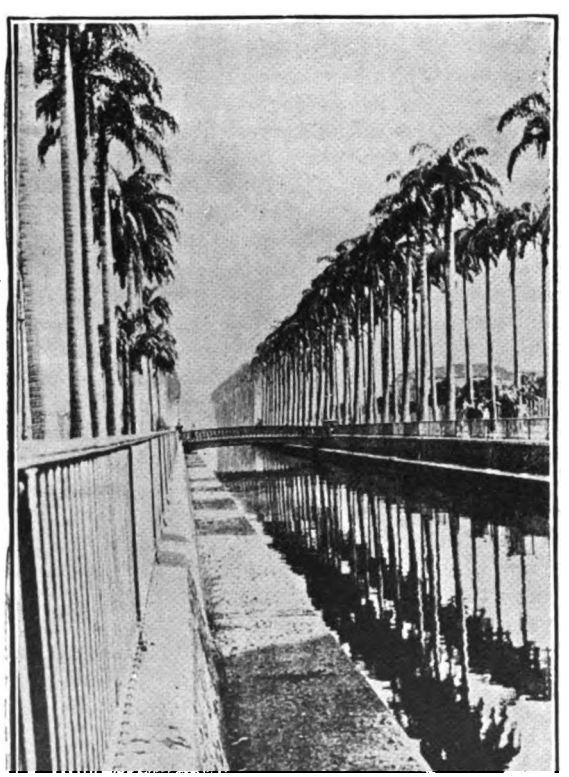
Advocates of the cement grout filler claim that the use of this material insures the joints being completely filled and waterproof. The mixture is usually made of one part cement and one or two parts sand, which, after mixing to the proper consistency, is swept into the joints.

Opponents of the cement grout filler claim that unless the pavement is kept free from traffic for a sufficient time to allow the grout to set thoroly the bond of the mortar will be broken. Even when the mortar is thoroly set it is claimed that its strength is not sufficient for traffic conditions, and the filler, therefore, serves the purpose no better than sand, while at the same time it is more expensive.

Those favoring the bituminous filler argue that the joints filled with a tar or asphaltic preparation constitute individual expansion joints between each block, thereby allowing for expansion thruout the pavement. Moreover, it is claimed that the pavement is made waterproof and that no moisture can enter between or under the blocks.

On the other hand, advocates of the other fillers argue that a bituminous material becomes soft and sticky from the oils that exude from the blocks and may add to the bleeding trouble. In practice, the bituminous fillers are most largely used and are giving the best satisfaction.

The top dressing most commonly employed is a layer of sand spread about one-half inch deep over the completed pavement. This sand fills up any small pockets that may be present and is more or less ground into the wood, making the pavement less slippery.



CANAL DE MANGUE

Rio de Janeiro, Brazil.

The sanitary condition of the East End, a portion of Rio de Janeiro, the capital of Brazil, rather low and swampy, has been greatly improved by the construction of a broad, beautiful canal which, besides being so picturesque, serves the useful purpose for which it primarily was constructed, that of draining the marshy ground and acting as a main outlet for the rain water that frequently comes down in torrents from the surrounding hills.

Rio is the home of the stately Royal Palm, for they are in evidence everywhere thruout the city. The Mangue Canal runs thru the center of the Avenida de Mangue, and there are four driveways along it, two on either side of the canal, as the Avenida is very broad. The ac-

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WATER WORKS PLANT

OF RIVER FOREST, ILLINOIS.

By Karl M. Mitchell, General Superintendent.

This interesting account of the development of the water works system of a small city is prepared by an official who corresponds to the city manager, now becoming so popular. He conducts a department of municipal news in the local weekly paper, and the data in this article were collected for use from time to time in that department.

PROBABLY the most important and pressing problem of the village government today is that of its waterworks. The consumption is rapidly increasing, while the water level in the wells is rapidly receding.

Until May 23, 1893, River Forest was dependent upon shallow wells for its water supply. In that year, having attained a population of 500 to 600, and under the influence of the progressive spirit dominating the world's fair period, culminated a movement begun some time previously for the construction of a works and distributing system.

A deep well 1,000 feet in depth was bored, a steam generating plant, deep well pump and a service pump were installed, a reservoir and a standpipe constructed, and several miles of mains laid covering most of the village south of Chicago avenue and west of Lathrop. Even a public fountain was not overlooked, and was installed at Park and Lake, where it was maintained for many years, since replaced by one of the modern bubbly type.

The maximum output of the works at that time, with a population of 600, was 150 gallons per minute. The population has since been multiplied by six, and the output less than doubled.

A few years later the deep well pump was replaced by an air-lift system. In 1904 a second well was driven, also being operated by the air-lift system. This was the last change made that increased the output of the plant.

In 1911 steam was displaced by electricity as a motive power. In 1913 reservoir No. 2 was constructed, to increase the storage capacity for fire and emergencies.

During the entire period that the water works has been in operation, Ernest Micklish has been in charge. There has been no serious mishap. One large leak in Lake street, a few years ago, was occasioned by electrolysis. The Concordia fire last February was the only fire that has taxed the capacity of the plant. While the plant is not efficient, judged by present-day designs and methods, the machinery as installed has been well maintained and extensive repairs have never been found necessary.

The steam plant was not removed at the time the electric plant was installed. Most of it is in good condition and serviceable. It should be sold. The air compressor and pumps particularly are in good condition.

During 1913 there was a marked increase in water consumption, caused by the connection to the water system of the stores in the bank building, the dairy, the college, all of which were large users, and a number of private residences. At the same time there occurred a marked drop in the water level in the wells, and a corresponding increase in the distance the water was lifted. As the capacity of the plant remained constant it followed that the quantity of water raised per hour was diminished.

The water department faced a double emergency. The output of the plant,

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which had been scarcely equal to the maximum demand in the summer of 1913, had decreased, while the consumption had increased.

A series of tests was conducted during the winter of 1913 to ascertain the operating conditions, to indicate the most feasible method by which the anticipated shortage in 1914 could be avoided, and to determine if possible means for increasing the operating efficiency.

The tests indicated that the plant was operating at an over-all efficiency from wells to reservoir of 14.2 per cent. The component parts of the plant were then tested and results analyzed to determine where the greatest losses occurred, and what changes could best be made to increase both the output and efficiency.

These tests resulted as follows:

Equipment (wells to reservoir)	Individual Efficiency Per Cent.	Input H. P.	Output H. P.	Energy Consumed H. P.
Motor	92	46.9	43.14	3.76
Belt	95	43.14	41	2.14
Air compressor	63	41	26	15
Wells	25.7	26	6.7	19.3
Total	14.2	46.9	6.7	40.2

The efficiency of the motor and belt was reasonably satisfactory, while that of the compressor could be materially improved only by the installation of a new compressor. The lowest efficiency and greatest consumption of power was found to be in the wells.

It may here be explained that our works are operated on the air-lift system. Compressed air is conveyed down the well a considerable distance below the water line and released within an upright discharge pipe. The air rises rapidly in the discharge pipe, forming with the water an emulsion lighter than the water, the buoyancy of which, together with the pressure of the water from beneath in the submerged discharge pipe, cause it to rise and flow out of the top of the pipe.

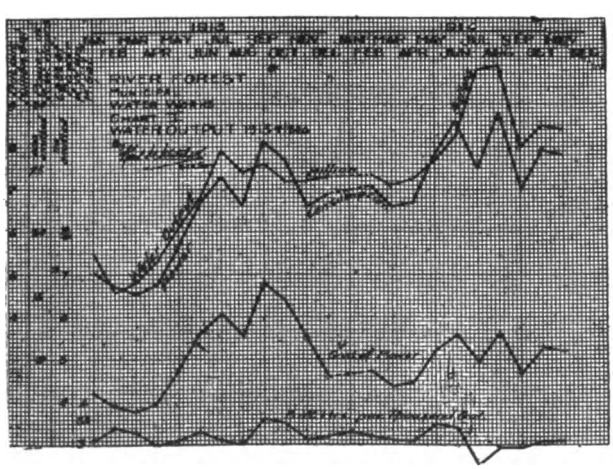
Its action is similar to that of the familiar coffee percolator, in which the expansive force, instead of compressed air, is steam generated at the bottom of the pot directly under a flaring hood or bell, which opens into a vertical tube. The steam collects under this hood until its expansive force drives it upward thru the tube to escape at the top, carrying with it a quantity of water which overflows.

The efficiency of an air lift depends upon the length of air and discharge pipes in the well, their size, the friction loss in the air line, the air pressure used and available, and the friction loss in the discharge line.

To secure the maximum efficiency from our air lift system will require the repiping of the wells so as to reduce the air and water friction losses, permit of a larger ratio of submergence, and a higher operating pressure.

Other important phases of the situation are also to be considered. The friction loss in a 6 or 8-inch well, such as ours, is greater than in 16 and 18-inch wells, such as operated by some of the neighboring suburbs. When pumped at a given rate the lift is less, i. e., the water level high-

RIVER FOREST WATER WORKS. *Output of water, consumption and cost of power and rate of use of electricity.*



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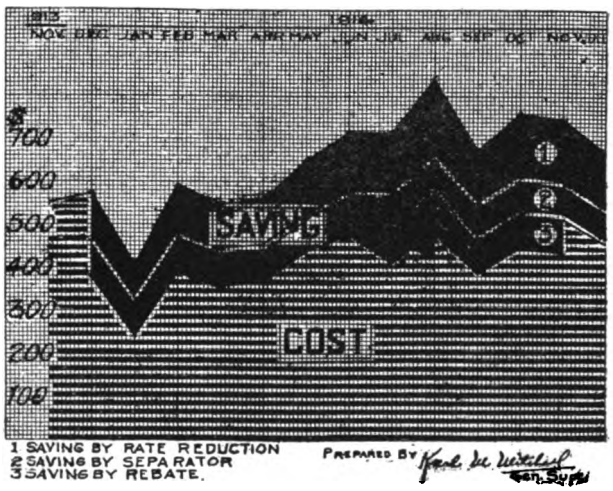
er, in a large well than in a small well.

The fact that the water level thruout this section is receding quite rapidly is of grave significance and suggests the possibility of the lift becoming so great, and consequently the power cost, that we may be obliged to secure Lake Michigan water.

The immediate problem last spring, however, was to provide sufficient water for the period of maximum demand in 1914, and to increase the efficiency if practical.



RIVER FOREST WATER WORKS. *Saving in cost of power by reduction in rate for electric current, by installation of air separator, and by rebate on bill for electricity.*

The most effective method to accomplish these purposes was determined to be the installation of a separator at the top of each well. Under the system then in operation the discharge pipe rising vertically from the well changed its direction and ran horizontally to the reservoir. As the operation of an air lift depends upon the buoyancy of the air, to be effective it must operate only in a vertical direction. When operated horizontally it becomes inefficient. A separator is simply a tank at the top of the vertical discharge pipe, which receives the water discharged, permits the air to escape, and which is elevated sufficiently to permit the water to flow into the reservoirs by gravity.

During the last of June a separator was installed on each well. Slight adjustment was also made in the length of air pipe in the wells, but within limits that could be operated by the present compressor.

The important thing accomplished by the installation of the separators was the increase in water output sufficient to avoid the threatened water famine and meet the unusually heavy demand of the summer.

In the table below is given the output of the water works in thousand gallons, by months, for 1914, with the increase in 1914, showing that the use of water in the earlier part of the year was much greater but not so much in the later months:

Month	1913	1914	Increase Thousand Gallons	Per Cent. Increase
January	5472	*4916	....	..
February	4616	7358	2742	59
March	4797	7102	2305	48
April	5280	7260	1980	37
May	6073	7717	1644	27
June	6819	8325	1506	22
July	7913	9772	1859	23
August	7380	9937	2557	34
September	7603	7980	377	5
October	7179	8535	1359	19
November	7160	8392	1232	17
December	7264	7710	446	6

*20 days only.

These figures are shown graphically on chart I. There is also shown the power consumption in kw. hours; the cost of power, not deducting the rebate, and the power consumption per thousand gallons pumped.

The large increase in water consumption in 1914 is due to the increase of 15 per cent. in the number of connected services, some of which, as the stores in the bank building, the college and dairy, were large consumers, and to a dry season.

It will be noted that the consumption rose from around 5,000,000 gallons in the first months of 1913 to between 7,000,000

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and 8,000,000 gallons in July, 1913, and that, instead of the normal drop that may usually be expected during the winter, the consumption was maintained at this figure thruout the fall and winter of 1913 and spring of 1914, until June, 1914, when it started upward again. In August the consumption was nearly 10,000,000 gallons, more than double that of February or March, 1913, and 11 per cent. in excess of the maximum output of the water works operating twenty-four hours a day for thirty-one days at any time before the separator was installed.

From the middle of May to the middle of June, tho we were operating twenty-four hours per day much of the time, our demand was in excess of our output, and we were obliged to purchase 680,000 gallons from Forest Park. The situation was critical. The shortage of water was real.

This condition had been anticipated, however, and, as a result of the investigations made during the winter, the installation of separators was authorized in June, and before the end of the month they were in operation and the famine averted.

Their installation increased the output of the wells 28 per cent., from 202 gallons per minute to 259 gallons per minute. This was for normal operating.

A test was made with both compressors running and an output of 385 gallons per minute secured, an increase of 183 gallons per minute, or 91 per cent. over the normal pumping rate before the installation of the separators. The water delivered during this test contained a considerable amount of milky white dust in suspension, and at the time occasioned some inquiry from consumers as to the cause. As this is the only test which has ever been made with both compressors running, it is not known whether the milky matter, probably limestone, will disappear after more prolonged pumping, but it is assumed that it will. This method of pumping is considerably less efficient than with one compressor only

put, the separators also increased the operating efficiency of the plant, raising a given quantity of water with one-sixth less power. This is indicated graphically in chart I, by the greater separation between the water output and the power consumption lines immediately after the installation of the separator, particularly when compared with the same months for 1913.

This is also indicated on the lower line, denoting the power consumed in k.w. hours per thousand gallons.

The fluctuations in the lower consumption per thousand gallons are due largely to fluctuations in the well levels and to changes in atmospheric and other operating conditions. The water level in the wells drops when under heavy pumping, and there is a gradual receding of the water level in all strata underlying the Chicago metropolitan district. An air compressor operates most efficiently in dry, cold weather. Its efficiency in damp and warm weather is lower, and the cost of power proportionately higher.

Up to December, 1913, our power rate was $0.025 per k.w. hour. During that month a reduction was secured based on a sliding scale, with a maximum of $0.02. In addition to this 20 per cent. reduction there was secured a rebate of $1,020, payable at the rate of $85 per month for twelve months.

During the twelve months ending November, 1914, there was paid for power $4,779.53. Had there been neither a rate reduction, rebate, or separator installation, the cost of power for the twelve months, based on the conditions existing in November, 1913, would have been $7,776.25. Two thousand nine hundred ninety-six dollars and seventy-two cents has therefore been saved during the year, distributed as follows:

Saving in cost of power, December 1913-November 1914:

By rate reduction	$1,587.20
By rebate	1,020.00
By separator (5 months)	389.52

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BRICK PAVING ON STEEP GRADES

A REPORT OF RECENT PRACTICE IN TORONTO, ONT.

By F. A. Churchill, Conneaut, Ohio.

The use of brick paving on streets with steep grades is a problem on which a number of engineers have been working for some years. The hillside block has been devised by brick manufacturers for use in such localities, and this paper describes the methods of construction of pavements, in which a special form of hillside block was used, and the satisfaction given by it.

THE city of Toronto, Canada, is constructing vitrified brick pavements by day labor. The work is being done by the Department of Works, under the direct supervision of M. A. Stewart, assistant engineer of roadways, and W. Barber, superintendent of construction, with W. C. Perkins, M. Am. Soc. C. E., chief engineer of the construction department of the Dunn Wire-Cut-Lug Brick Company, as consulting engineer.

In Toronto, the long-debated question of the advisability of municipalities themselves doing constructional work on civic improvements of a major character, was long ago settled, whether success be defined in terms of dollars and cents or measured by standards of efficiency. Toronto now has a philanthropic motive in doing its own structural work. The war in Europe has borne heavily upon the business world in the Dominion, and thousands of men, women and girls are either out of work or are employed intermittently. The problem of caring for the worthy unemployed is a grave one. Canada is trying to solve the problem with courage, generosity and resourcefulness. It is said that the city of Toronto has had on its pay rolls six thousand men engaged in public works of various kinds, and the city will endeavor to give these men a daily wage as long as weather conditions permit.

The constructing of public improvements by day labor has been a blessing to thousands of wage earners, and has also proven to be sound economic policy, owing to the personnel of the engineering corps of the city government.

Up to the close of the year 1912 there were approximately 420,000 square yards of brick pavement in the city, laid on a concrete foundation varying from 4 to 6 inches in depth; 15,031 square yards laid on a broken stone base; 32,009 square yards laid on gravel. The first brick for paving construction was laid in 1895.

In 1913 there were 1,207,892 bricks laid. Of this number 727,160 were wire-cut-lug brick, the first laid in the city. They were first laid on Merton street, in North Toronto, from Yonge street to a point 2,300 feet east, as a test. The pavement was constructed 28 feet wide between curbs, on a 4-inch concrete foundation, with 1½-inch sand bed and cement grout filler, 1 to 1 mixture. A contract was let, on competitive bid, to the Bessemer Limestone Company, of Youngstown, Ohio, for repressed paving brick. Later the city satisfied itself that wire-cut-lug brick was preferable to repressed brick, and it asked the Bessemer Company to substitute the former for the latter at the same price.

In 1914 there were laid, by the day-labor organization of the city, approximately 1,523,200 regular wire-cut-lug brick, and 354,000 of the same brick by

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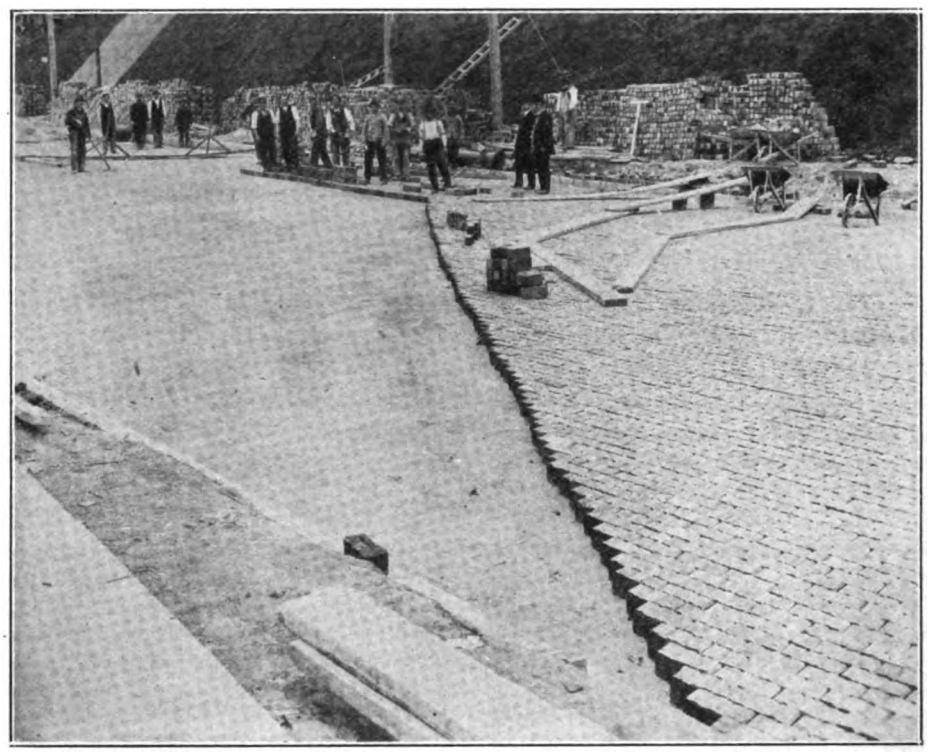

CHRISTIE STREET HILL, *Toronto, showing method of laying hillside blocks lengthwise of street. Note how blocks break joint so that grooves do not match.*

contract, the only kind now specified. In 1915 it is anticipated that sufficient paving work will be projected to require approximately 4,000,000 brick; the realization of these hopes depending somewhat upon economic conditions resulting from the effect of the European war.

Toronto has made a notable departure in putting in a wire-cut-lug hillside brick pavement on Christie street hill, the second of the kind ever laid. This new type of brick combines the distinctive features of wire-cut-lugs, square edges and beveled ends with two transverse grooves, about three inches apart, on the wearing surface. As is the case with ordinary hillside brick pavement, each groove is no longer than the width of the brick. This affords shoe calks opportunity to get a grip almost anywhere, yet, as the grooves are broken up at short intervals, broad tires bridge them on alternate courses of brick and roll over the pavement without experiencing an appreciable jolt.

The United Brick Company, of Greensburg, Pa., in 1914 shipped to Toronto 143,000 wire-cut-lug hillside brick from their Conneaut (Ohio) plant, and another order of 100,000 has been placed for the steep grade in Bathurst street. The same company has the contract for furnishing wirelcut-lug brick in 1915.

Christie street hill has a grade of 6¼ per cent. It was paved 46 feet wide for a distance of 700 feet, with a double course granite block header at the base

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seen by an examination of the accompanying picture, which was taken before the pavement was grouted or rolled or cleaned off. No V-joints are needed on curves.

In structural details, the pavement has a natural sub-base; a 6-inch concrete foundation; a 1½-inch sand bed; cement grout filler, 1 to 1 mixture. Sand for the bed was taken from a cut on Bathurst street hill. The sand is extremely fine, but not gritty. It seems to be a sort of dry quicksand, but it is easily compacted into a firm bed, and shows no tendency to roll up or to mush in spots. At every stage of construction work the engineers were attentive to details, and every mechanical aid to good work was provided for the workmen.

The final constructional stage, the grouting, was given the close attention its importance demands. A rather coarse, well screened pit sand and a good quality of Portland cement were used for grout. These ingredients, 1 to 1, were first thoroly mixed dry and then they were reduced to the proper consistency by mixing with water in a grout box. The mixing in both instances was done by hand, and the grout in the box was stirred continuously until it was scooped out with shovels and poured into the joints of the pavement.

The grout box was a very serviceable and practical adjunct to construction, and as it differed from grout boxes in common use in the States, a brief description may be of interest to contractors. It is a rectangular box, made of planking, mounted upon two wheels about 12 inches in diameter and fitted with two 6-inch legs and two handles similar to wheelbarrow handles at the rear. The bottom joints of the box inside are finished with a triangular molding to prevent grout collecting in the angles. Because it can be trundled from place to place very easily, and because the wheels are so placed with respect to the axis of the box that the latter can easily be tipped so that the contents will flow to the lowered end of the box for scooping, the implement is both a labor saver and an aid to good construction. No grout was dumped. All was scooped and poured, a method which as-

CHRISTIE STREET HILL, *Toronto, looking up 6.25 per cent. grade. Wire-cut-lug hillside blocks not yet rolled or culled.*

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CHRISTIE STREET, *Toronto, under construction. Laying wire-cut-lug hillside blocks on* 6.25 *per cent. grade, city work by day labor.*

sures filling of the joints. In deference to the law of gravitation, grouting was begun at the foot of the grade, as otherwise the thin grout would have flowed down the longitudinal joints and overflowed the lower part of the pavement. Small quantities, by the shovelful, were poured at a time, and the surplus grout was quickly brushed forward up the grade. The final course of grout was squeegeed until the surfaces of the joints were flush with the pavement, care being taken to keep the joints full until the setting began. This assured a smooth, even surface.

After the final course of filler began to set, the transverse grooves in the brick were brushed out with wire brooms. The brushing was not really necessary, as the grout in the grooves wears out under the impact of horses' shoe-calks, but the process makes the grooves serviceable at once. The pavement was laid in November, 1914.

The Christie street hill is a beautiful piece of pavement, and its counterpart will be constructed on Bathurst street hill, possibly this winter, but certainly next spring. The level portion of Bathurst street, from the crest of the hill to Nina street, was paved with wire-cut-lug brick early in November, 1914.

The city safeguards itself in the purchase of materials by the competitive bidding system and also by submitting work to bidding by contractors, and some work is done by contract. It occasionally happens that the city rejects all bids as in excess of reasonable figures, and then readvertises. If the city finds that it can do its own work as cheaply as it can be done by contract, and is in position to handle it, the city does the work. This plan assures good work, as Toronto is fortunate in commanding the services of engineers who are not only capable but also conscientious.

February, 1915.

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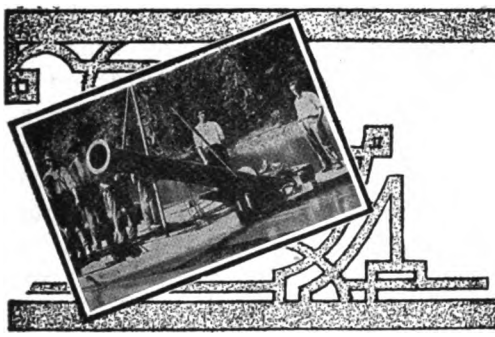

EDITORIAL

CENTRALIZATION AND LOCALIZATION

In local matters home rule has been demonstrated to operate successfully. An editorial last month noted the demonstration of this statement which has been made in German cities and the delays and losses due to centralized control by various State Boards in England. Part of the inefficiency in the English system is due to the fact that, while the field in which each Board acts in centralized, the Boards themselves have no definite centralized control and there is the usual consequent duplication and red-tape delay.

Some governmental functions are, however, of a general rather than a local nature, tho the carrying out of the work belonging to them is largely entrusted to the local authorities. Of such nature are common school teaching and road building and maintenance. In each case it is true that the details are taken care of by the smaller units of local government while, very properly, the general supervision, determination of qualifications of the workers in the field, checking of quality of results, and the like is or should be in the hands of the State authorities.

The State of Indiana exhibits the consequences of two methods of treating these matters, which, while very different in processes and in the materials with which the work is done, and in methods of measuring results, still have many points of view in common.

Some seventy years ago the schools were in the same condition as the roads are at the present time. Each township operated its own schools, each school district controlled its own school and selected its teacher thru the designated official, there being no method of determining the qualifications of the teacher, no standard of compensation other than the money available, no standard of determining the results of the teacher's work and changing them if wrong. One teacher would perhaps learn how to teach to be moved on and his or her place taken by another of little or no experience. The analogy with present township control of roads and repair of roads by the district supervisors is complete in every item named above.

The school system of the State grew by the establishment of the county examiner to determine the qualifications of teachers; the State Superintendent to advise with county superintendents and teachers and aid personally,

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in associations and by printed matter; the establishment of county institutes and of state schools for the instruction of teachers; the increase in requirements made of county superintendents in supervision and instruction of teachers; the continually increasing demands made of teachers as to preparation for their work and experience therein; the co-ordination and co-operation of city and country in bringing up the standard of instruction, in producing greater efficiency in methods of expending the money raised for educational purposes, in measuring results and changing methods to improve those results; the division of expense in part according to the desires and needs of the local communities, in part, especially as to supervision, according to the needs of the counties, and in part according to the population, especially as to funds derived from the State treasury more or less directly; the recovering of national aid and its distribution to localities thru a state authority.

All this program has taken seventy years to bring the school system to its present efficiency and the highly centralized system is now admittedly equal to if not the best in existencewhether measured by true economy of expenditure or by quality of results, demonstrating its high state of efficiency.

Every worker on the roads, every officer needed to secure efficient work, every process, method or result needed for efficient administration of the roads has its exact counterpart in the program laid down in the preceding paragraph. The present inefficiency in road work and extravagance in expenditure is due wholly to the fact that the road problem is just where the educactional problem was seventy years ago. It is to be hoped that the road question will not remain always seventy years behind, but that the lessons to be drawn from the development of one system can be applied promptly and rapidly to the development of the other.

It seems strange that two matters equally close to the hearts of the people, on which their advancement and prosperity depend to so great an extent should have had such different treatment. Possibly this is due to the less confidence of the people in their ability to manage all details of their educational activities, but that is doubtful. Possibly the difference lies in the early start made in educational lines when roads were so hopeless and money to make them was so infinitesimal that nothing could be done. Indeed, it is not thirty years since the first workable gravel road law was passed and the present really creditable condition of local roads in the State is the result of but thirty years of work. Just as in the school system, expert central guidance is needed to make the results more nearly commensurate with the expenditure of money and to bring to a higher qual-

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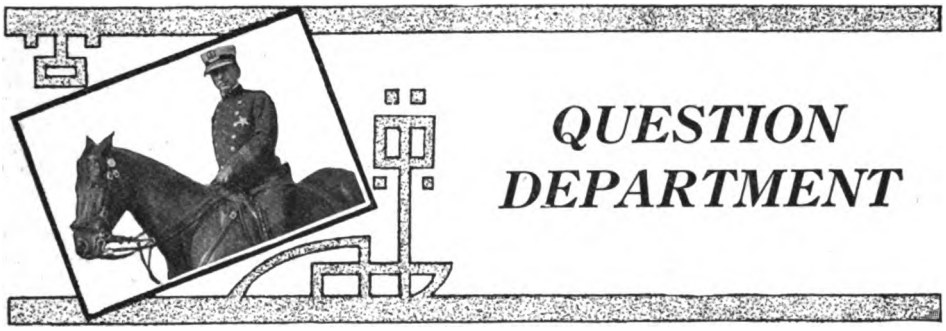

QUESTION DEPARTMENT

Forms for Electrical Inspection Work

I would like to get hold of a blank set of forms (applications for permits, etc.) such as used in connection with electrical inspection work in smaller cities. Can you furnish such a set, or refer me to a small city which is enforcing such an ordinance?

S., ———, S. D.

Will our readers send samples of the blanks they are using for the benefit of our correspondent? They may also be published for the benefit of others if permission is given.

Municipal Electric Light Plants.

Could you give me information about any of the following:

The lowest rate charged per kw.-hr. for lighting purposes by a municipally owned light plant in the United States;

The average charge in the United States per kw.-hr. by municipally owned plants compared with private plants.

We have a small town here of 5,000 people and own our water and light plant and the charge for current is 6 2-3 cents per kw.-hr. There is a movement on foot now to sell this plant and I am opposed to the sale and would like to get all the information I could that would be of help. If you could send me anything showing how towns had made mistakes, had their contracts broken, rates raised and unsatisfactory service I would very much appreciate the favor. B., ———, Tenn.

These questions open up the whole vexed question of municipal versus private ownership of public service utilities, but there will be no attempt to discuss them here.

The first question cannot be answered directly without giving a wrong impression. Thus, Cleveland proposes to supply electric current from its large municipal plant at 3 cents a kw.-hr., and has done so with fair success from two small plants supplying limited districts which it has had in operation for some years. The stations in 1902 which is out of date as to actual costs because of the great improvements made in electric lighting since that date, but it may serve to make some comparisons between the results of municipal ownership and private ownership.

Thus the average income per arc lamp in use for commercial or other private service was $48.88 in private plants and $41.46 in municipal plants per year. For incandescent lamps the average incomes were $2.40 and $1.92 respectively. For arc lamps in public service the incomes were $83.20 and $69.88 and for incandescent lamps in public service $6.06 and $5.93 respectively.

These incomes vary somewhat with the population. Thus in privately owned stations furnishing electricity only, arc light incomes per lamp were as follows:

Population.	Commercial Service.	Public Service.
Under 5,000	$53.80	$65.56
5,000 to 25.000	46.63	71.66
25,000 to 100,000	43.04	77.12
100,000 to 500,000	42.72	83.44
500,000 and over	58.82	111.97

For incandescent lamps the incomes were as follows:

Population.	Commercial Service.	Public Service.
Under 5,000	$2.53	$8.74
5,000 to 25,000	2.32	6.99
	2.72	10.17

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Incomes per arc lamp per year:

Population.	Commercial Service.	Public Service.
Under 5,000	$44.74	$61.27
5,000 to 25,000	40.67	64.79
25,000 to 100,000	35.77	51.88
100,000 to 500,000	....	70.24
500,000 and over	....	110.36

Incomes per incandescent lamp per year:

Population.	Commercial Service.	Public Service.
Under 5,000	$2.01	$7.62
5,000 to 25,000	1.70	5.46
25,000 to 100,000	2.54	3.99
100,000 to 500,000	0.87	4.96
500,000 and over	....	4.58

It will be noted that the incomes are less in the municipal plants in every case but one, indicating lower rates.

Municipal ownership is exercised mainly in the smaller cities. Of the 17,797 arc lamps reported in municipal plants, 16,734 were in use in plants in cities of less than 25,000 population.

Incandescent lamps in private service were largely 16-c.p., while those in public service were largely 32-c.p. or more and are burned more continuously, accounting for much of the difference between the incomes in the two classes.

Taking the outputs of current reported and the total incomes therefrom, the private plants seem to have received 3.35 cents per kw-hr. and the municipal plants 3.49 cents.

These figures can none of them be compared with any certainty of correct conclusions because of the differences in methods of accounting in use in private and municipal plants and in different plants in each class. Few plants, either public or private, make proper allowances for such items as depreciation and interest on investment, working capital and reserves for contingencies. Municipal plants have the added difficulty of making the proper allowances for public service, in many cases no such allowance being made and in others the allowance being insufficient.

A decision for or against selling the plant should be made, in a state not having a public service commission, only after a careful study by an expert of all the conditions and the careful working out of a franchise which will give the city rather than the company the advantage as to control. A franchise which will insure that the company will receive full compensation for the use of its capital actually invested and the ability shown in the management and will at the same time give the public and private consumers the best service possible for the money they pay for it is the best for both parties in the long run. It takes an expert unbiased in favor of or against municipal ownership to draw such a franchise.

Mere difference in rates offered by a company should not decide the question. That is a matter which should be open for revision at intervals sufficiently frequent to insure that the consumers get their share of the improvement in service or lowering of cost which comes so often in the electric lighting field.

Municipal ownership seems to be successful in proportion to the distance the plant is from political manipulation. In cities where this distance is great the successes are marked. In cities where the plant is a political football the failures are just as marked.

Reference may be made to the article on "A Modern Franchise for a Public Utility" elsewhere in this number of MUNICIPAL ENGINEERING for some suggestions as to the matters which should be included in a franchise in case it is decided to consider seriously the matter of granting one.

Permanent Water Meter Record

We are desirous of getting an office record for our meter readings separate from the record that the man that reads the meters uses and we are taking the liberty of addressing you to inquire if you can not recommend a good form for us. We would like if possible to get a form that will show two or three years' readings on the one sheet and also a sheet that has only one name on it. This is to be a permanent record of the office and something that is simple and that will contain all the information that would be required for a permanent record.

D., ———, Mont.

Forms of water meter records for office and for the meter reader will be found in MUNICIPAL ENGINEERING, vol. xlii, p. 251; vol. xliv, pp. 233 and 522, and vol. xlvii, p. 293. The last named is a reproduction

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the meter readers' books, the amounts due and payments made. It is published by Engineering Publishing Co., 702 Wulsin Bldg., Indianapolis, Ind.

Gravity Concrete Mixers

I would like to know the names and addresses of several companies making gravity mixers, for making concrete, such as the Gilbreth Trough Mixer, described in the book "Concrete Construction" by Gillette & Hill.

P., ———, Porto Rico.

Inquiry may be made of the following firms: Automatic Concrete Mixer Co., 143d street and Southern boulevard, New York; Buffalo Concrete Mixer Co., Buffalo, N. Y.; Hains Concrete Machinery Co., 286 Fifth avenue, New York; Ransome Concrete Machinery Co., Dunellen, N. J.; Littleford Bros., 444 East Pearl street, Cincinnati Ohio; Union Elevator & Machine Co., 214 West Ontario street, Chicago, Ill.

Box Car Unloaders and Conveyors

Can you give me the address of several reliable parties or firms making box car unloaders suitable for unloading sand, soda-ash and lime into storage bins whose loading doors are closely adjacent to the tracks and are on the same level and conform to the shape of the box car doors?

At present we unload these materials from box cars into storage bins, the floors of which are on the ground level. The material is shoveled or wheeled in wheel barrows from the box car into the bins, which, of course, keeps the top level of the stored material from being much above the floor level of the car and requires a large floor area to store any considerable quantity of any of the materials. From the bins the materials are again loaded into wheel barrows, weighed and dumped into a pile in certain proportions and mixed by hand and again loaded into wheel barrows and wheeled to the back of the melting tanks and dumped and then shoveled into the tank hoppers to be melted.

Now we want to get away from all this handling by hand and have in mind a system of which I am asking you to supply me the names of concerns manufacturing the detail parts. We are thinking of a plant whereby we can mechanically unload the materials we use from box cars, each material into its respective hopper, from which it will be fed either into a vertical chain bucket elevator or elevator of some other type and elevated into storage bins some thirty or forty feet high. The various materials will then be fed by gravity out of these bins to a scale and weighed and then onto a conveying belt and to a mixer and mixed. The resulting mixture will then be elevated and carried by conveyor.

O.; Webster Mfg. Co., Tiffin, O.; Chain Belt Co., Milwaukee, Wis.; Link-Belt Co., Nicetown, Philadelphia, Pa.; C. O. Bartlett & Snow Co., Cleveland, O.; Robins Conveying Belt Co., 13 Park Row, New York, and others can supply designs as well as all or part of the machinery necessary.

Electrolytic Sewage Disposal

In your issue of February, 1913, p. 135, you describe "Municipal Plants for Electrolytic Sewage Purification." This article has appealed to me very much as being the proper method of sewage disposal for cities that are situated in an agricultural district. I would like to know if the process is patented, and if so, who is the patentee, and where could I reach the party by letter. We have in a radius of 100 miles some seven or eight cities with a population of from 2,500 to 20,000 inhabitants where the above described process appeals to me as being the only satisfactory solution of the sewage problem. Nearly all of these cities are polluting fresh water streams that are used largely for irrigation purposes, as well as domestic supplies. Complaints are becoming so numerous from the agricultural districts that use this polluted water that the city officials of the different cities will be compelled to abandon the present method of disposal.

L., ———, Wash.

The writer has tried to obtain definite information from those interested in the electrolytic process of sewage treatment described in the above mentioned article and has been promised a full description when the Oklahoma City plant was put in good working order. Nothing having been received, it is presumed that the plant has not yet been made successful. The city engineer of Santa Monica, Cal., or H. V. Hinckley, consulting engineer, Oklahoma City, Okla., can possibly put inquirers in touch with the designer or patentee of the system.

Safe Specifications for Reinforced Concrete Sewer

Will you kindly tell me if the following specification for a drainage ditch is safe?

This work to be monolithic. Greatest depth about 14 ft. The sections to be round and the walls the same thickness clear around. Mixture 1-5 gravel concrete and the ditch runs rock, clay, sand and gravel with ground water.

The walls of the 72-in. and 60-in. arch are to be 5-in. thick, the walls of the 54-in. and 48-in. arch are to be 4-in. thick, the walls of

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strength of conduit walls as a sewer would.

The section relating to thickness of reinforced concrete sewer pipe was not adopted, because the thickness proposed by the committee preparing the specifications was considered to be greater than is necessary, by the manufacturers of reinforced concrete pipe. They presented their idea of the proper thicknesses and the section was laid over for further consideration, and will come up for amendment and adoption at the next convention to be held in Dayton in October, 1915.

The following table shows the thicknesses of pipes of various diameters proposed by the committee and by the pipe manufacturers:

Diameter of pipe, inches.	Thickness in inches proposed by Committee	Manufacturers
24	3	2.5
30	3.5	2.75
36	4	3
42	4.5	3.5
48	5	4
54	5.5	4.5
60	6	5
66	6.5	5.25
72	7	5.5
78	8	5.75
84	8	6

It will be noted that with two exceptions the thicknesses proposed by the manufacturers agree with those given in the question, and in those two cases are 0.5 inch greater.

The section governing proportions of materials reads as follows: "The concrete used in the manufacture of cement concrete pipe shall be composed of a mixture of the best quality of portland cement, clean, sharp sand, and clean broken stone or gravel suitably graded and equal in quality to similar materials specified herein for concrete, and properly proportioned to produce a pipe that will comply with all the requirements specified in sections named, (governing method of making, tests and dimensions).

The sections governing reinforcement provide that the steel shall comply with given requirements of the American Society for Testing Materials; that it shall be either expanded metal, rods or wire mesh, equal in quality and design to that manufactured by the American Steel and Wire Company; that in pipes 24 to 48 inches in diameter the reinforcement shall be placed 1 inch to 1.5 inches from inner surfaces, according to diameter of pipe and that either one or two lines of reinforcement may be used; that two lines of reinforcement shall be used in pipes over 48 inches in diameter one 2 inches from the inner surface and one 1.75 inches from outer surface.

While it is probable that reinforced concrete pipe in length may be made better than continuous reinforced concrete pipe made in place, the thicknesses for the latter would not vary greatly from those for the former under the same conditions, and the absence of joints in a water-bearing, sandy soil might be a considerable advantage in favor of the latter.

Unless there are special reasons for requiring greater than the standard strength in the particular case described, either of the specifications given in the table should secure a sewer or drain of sufficient strength.

Proportions of Lime Mortar

Will you please advise us if you publish any tables showing the ingredients required to make one (1) cu. yd. of lime mortar in the various proportions, such as one part lime to 1-2-3 of sand. We desire these tables to show the proportions by weight of dry sand and lime. The quantities of sand may be expressed in terms of cubic yards, estimating the sand to weigh 100 lbs. per cu. ft.

We have in our office a table of this kind on Cement Mortar, prepared by Mr. L. C. Sabin, Asst. U. S. Engineer, and we are trying to secure the same kind of information applicable to lime mortar.

We are after authoritative information and if you have no tables of the sort above described, any information directing us will be appreciated. L., Pittsburg, Pa.

The writer does not know of tables of the kind mentioned. Merriman's "American Civil Engineers' Pocket Book" ($5) states that the lime in commercial barrels of about 200 pounds net will make about 2½ barrels of stiff lime paste. One barrel of the paste and three barrels of good sand will make about three barrels (0.4 cubic yard) of mortar. One barrel of unslaked lime will make about 0.95 cubic yard of 1:3 mortar. From the first statements made the barrel of unslaked lime would make about one cubic yard of mortar when mixed with 7½ barrels of sand. Also a barrel contains 0.133 cubic yard, or 3.6 cubic feet.

Baker's "Masonry" ($5) gives 2¼ barrels of paste from one 230-pound barrel of unslaked lime.

Can our readers refer our correspondent to a source of the desired information?

An article in MUNICIPAL ENGINEERING, vol. xxviii, p. 4, gives comparisons of strength of high calcium and dolomite lime to the advantage of the latter, but does not give any information as to volumes of the mixtures used. The "Hand Book for Cement Users" gives the same information and statement of trade customs regarding hydrated lime.

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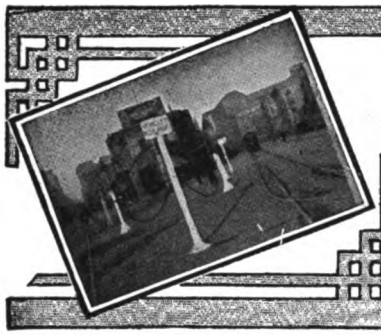

WORKERS IN THE FIELD

How to Apply Filler to Vertical Fiber Brick Pavement

The Editor of MUNICIPAL ENGINEERING:

Sir—I note in the Question Department of the January issue of your magazine the article on laying vertical fiber brick pavements, and also that the question is asked, "Just how should asphalt be flushed on and how much asphalt per square yard should be used where paving is laid on 1½-inch sand cushion?"

Vertical fiber brick are laid flat instead of on edge, have a recticulated or roughened surface, and the bricks are laid and rolled as is usual with brick pavements, and the asphalt in this type of construction is applied somewhat differently. Instead of using a pouring can and filling the interstices, a little different grade of asphalt than the ordinary asphalt filler is used and is poured from an ordinary bucket directly onto the brick, and it is pulled over the surface of the brick while hot by the use of a squeegee. It is necessary that the asphalt be extremely hot and have a wide range of temperature between its melting and congealing points in order to allow of the asphalt filler penetrating the interstices of the brick before congealing.

We are sending you under separate cover a copy of our asphalt filler book and would ask that you refer to pages 9, 11, 13, 15 and 17, which outline the specifications for asphalt filler for brick pavements, together with the method of application.

G. L. SCHOMBURG,
Paving Department, Standard Asphalt & Rubber Co., Chicago, Ill.

The following extracts from the booklet referred to will show the differences between the asphalts used for filler in ordinary brick pavements and in vertical fiber brick pavements, also the differences in methods of application, based on the experience of the company with which our correspondent is connected:

For ordinary repressed brick or block pavements, the following specifications are recommended:

The interstices, or joints, of the brick (or block) shall be completely filled with Sarco asphalt filler, or any asphalt filler equal thereto, which must conform to the following standard of quality:

(a) It shall contain not less than 98 per cent. pure bitumen soluble in carbon disulphide (CS_2).

(b) Of the total amount soluble in carbon disulphide (CS_2) 98½ per cent. shall be soluble in carbon tetrachloride (CCL_4).

(c) When tested with a No. 2 needle weighted with 200 grams operating for one minute at 32 degrees Fahrenheit, it shall have a penetration greater than twenty-five (Dow method).

(d) When tested with a No. 2 needle weighted with 200 grams operating for seconds at 115 degrees Fahrenheit, it shall have a penetration greater than eighty.

(e) When tested with a No. 2 needle weighted with 100 grams and operating for five seconds at 77 degrees Fahrenheit, it shall have a penetration between the limits of thirty-five and fifty.

(f) Its specific gravity at 60 degrees Fahrenheit shall be greater than .975 and less than unity.

(g) It shall have a melting point not lower than 225 degrees Fahrenheit.

The filler shall weigh not less than eight nor more than eight and one-half pounds per gallon at 60 degrees Fahrenheit. It shall remain ductile at all climatic temperatures to which it shall be subjected, shall be water-proof, acid-proof and impervious to street liquids. Shall adhere firmly to the brick (or block) and be pliable rather than rigid, thus providing for expansion, contraction and all traffic conditions.

The filler must be heated sufficiently to allow proper pouring or squeegeeing (about 400 degrees Fahrenheit), taken from the kettles in buckets and poured from pouring cans.

The contractor must be equipped with pouring cans especially designed for this purpose.

Before pouring the asphalt filler care should be taken to see that all bricks (or blocks) are in a bone-dry condition.

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All joints at both sides and edges of the bricks (or blocks) must be filled completely by pouring or squeegeeing the material directly into and flush with the top. The material as poured shall be at a temperature of not less than 350 degrees Fahrenheit nor more than 400 degrees Fahrenheit. As the work progresses and while the material is still hot there shall be sprinkled over the entire surface a layer of clean, dry sand (preferably heated).

The filler is poured in the joints of the brick from specially prepared cans, which consist of a funnel-shaped receptacle, narrowed down to a tip at one end, furnished with a handle projecting from the other, and a valve-rod controlled by the operator for opening the delivery at the end tip.

The pouring is done by placing the tip in the joint of the brick, walking slowly backward, at the same time allowing the filler to flow so as to completely fill each joint. The tip rests in the joint and will therefore act as a guide, preventing the spilling of the material on the surface, provided reasonable care is taken.

For vertical-fiber brick pavements:

The asphalt filler used in the construction of a repressed brick or block pavement would not suffice for the vertical fiber brick, inasmuch as the asphalt filler is not only placed in the interstices of the brick, but is applied to the surface, and, consequently, must cope with different conditions.

The application of the asphalt filler for a vertical-fiber brick differs slightly from the method employed for a repressed brick or block.

The asphalt filler is heated in the same manner but is brought on to the work in open buckets and is poured on the surface of the brick in a semicircle with a dragging motion. Men equipped with iron squeegees, which are heated to a glow—and these squeegees must always be very hot—pull the asphalt filler toward them over the surface of the brick, leaving as little as possible on the surface, not to exceed an eighth of an inch.

A hill of sand is spread from gutter to gutter directly behind the men with the squeegees, and immediately after the filler is applied, and before it has had its initial set, the sand is pushed over the asphalt, allowing one-half of an inch of sand to remain on the surface. This sand will be gradually forced into the asphalt coating by traffic and will add to its stability.

The following asphalt filler specification is recommended for vertical-fiber brick:

The interstices of the brick, as well as the joints next to the curb, railroad tracks and around manholes or other street structures, shall be completely filled with an asphalt filler complying with the following requirements:

The asphalt filler shall be composed of asphalt containing at least 98 per cent. of bitumen soluble in carbon bisulphide. At least 98½ per cent. of the contained bitumen soluble in carbon bisulphide shall be soluble in cold carbon tetrachloride. The penetration shall be uniform in consistency and shall not vary more than seven and one-half points in penetration from the following standard:

No. 2 needle, 1 minute, 200 grams at 32 degrees Fahrenheit, 30.

No. 2 needle, 5 seconds, 100 grams at 77 degrees Fahrenheit, 40.

No. 2 needle, 5 seconds, 50 grams at 115 degrees Fahrenheit, 60.

The above filler shall be water-proof, shall adhere firmly to the brick both in the joints and on the surface, and shall remain ductile and pliable at all climatic temperatures to which it may be subjected. It shall not run in the joints during the hottest summer weather nor become hard or brittle when cold. The melting point shall be not less than 225 degrees Fahrenheit nor more than 275 degrees Fahrenheit. The brick shall be dry and the asphalt filler shall be applied at a temperature of not less than 375 degrees Fahrenheit nor more than 450 degrees Fahrenheit by means of hot squeegees especially adapted to the purpose. The joints shall provide sufficient hot material on the top surface to fully cover the etched or reticular surface with a thin coat of the hot asphalt.

A top dressing of one-half inch of coarse dry sand (preferably heated) shall be spread immediately after the filler is applied, and before it has had its initial set, and shall immediately be rolled with a roller weighing not less than three nor more than five tons until the sand is thoroly embedded in the asphalt filler. As soon as the sand has been thoroly ground into the top dressing of asphalt by traffic the surplus may then be swept clean.

Ordinances Regulating Street Excavating—Replacement by City.

The Editor of MUNICIPAL ENGINEERING:

Sir—In the January issue of Municipal Engineering, page 40, we find a letter asking for information as to latest improved ordinances regulating excavations and improvements made by gas companies, etc., together with the statement that the writer knows of no such ordinances and asking if any reader can furnish same.

We herewith attach copy of portions of the ordinance under which we are working relative to this subject and under which the street department of our city

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backfills all excavations and replaces all pavement at the expense of any public utility company or other party requesting the cutting of such pavement. This ordinance works very satisfactorily with us and has relieved the city of the frequently disputed question of responsibility for settlement of pavement and as to whether same was caused by excavations thereunder, etc.

The city, doing all this work itself, keeps experienced men for such work, does its work thoroly and very seldom experiences any trouble over settlements. Utility companies and others appreciate having the work done by such experienced men, thus relieving them of any responsibility in connection therewith.

In our annual report for 1914 you will find further reference to this matter, together with other information which may be of interest in this connection.

CHAS. R. CASE,
Supt. of Streets and Sewers,
Seattle, Wash.

The portions of Ordinance 25150 relating to backfilling and replacing pavement cut read as follows:

"Section 5. That in all cases where the city of Seattle shall have acquired assignments in whole or in part of any such maintenance contract, the superintendent of streets, under the direction of the board of public works, shall make all repairs in the pavements necessitated by reason of cuts and openings made therein in laying or relaying any gas, sewer or other pipes or conduits by persons thereunto authorized by permit. Before any such permit shall be issued for the breaking up or opening of any pavements, there shall be deposited by the applicant in the guaranty deposit fund a sum of money equal to $2.00 per cubic yard for each yard of earth to be used in the backfilling of any such opening, $5.00 for the first square yard of pavement necessary to be broken up and $3.00 per square yard for each yard of pavement after the first yard so to be broken. Upon the laying down of said gas pipe, sewer pipe, water main or other pipe or conduit in accordance with such permit, the superintendent of streets shall immediately take charge of the trench in which such pipe or conduit shall have been laid and shall proceed to refill same and repair the pavement thereon. Upon the completion of said work by the superintendent of streets, a verified statement of the cost thereof shall be furnished to the city treasurer and one copy of which shall be filed with the city comptroller. (Upon the completion of such work by the superintendent of streets, he shall certify such fact to both the city treasurer and the applicant, with an itemized statement of the cost thereof.) The city treasurer shall thereupon, upon the surrender of said original guaranty deposit voucher, without further ordinance or order, pay to said applicant the balance that may be due as excess on said deposit. In computing the charge to be made for such work, there shall be added, by the streets and sewers department, the sum of 10 per cent. of the actual cost of such labor.

"Section 6. Instead of making deposits in advance for each and every cut or opening to be made, as provided for in Section 5 hereof, and as an alternative thereto, any person, company or corporation desiring so to do may deposit with the city treasurer from time to time to the credit of the department of streets and sewers the sum of $500 and shall replace said sum from time to time whenever such person, company or corporation shall have been notified by the street and sewer department that the amount of such deposit remaining shall have been reduced to the sum of $50 or less. Such deposits shall be used in the same manner as set forth in Section 5 hereof."

From the annual report the following facts are gathered:

"The year's average shows a cost of 93.3 cents per square yard for repairs to cuts and worn holes in asphalt pavements, and $1.9167 for brick pavements."

"Side-sewer contractors have heretofore been required to put up cash deposits for backfilling and replanking or repairing cuts made in streets. We have eliminated this method and are holding bondsmen of such contractors liable for all such bills.

"In the case of the larger building contractors, instead of each department requiring a cash deposit to protect itself against unpaid bills for work done or damage to city utilities, we have encouraged the filing of a bond covering all these matters, we notifying other departments of the filing of such bond and their protection thereunder.

"Deposits are still necessarily required of smaller contractors using streets as a protection against damage to same and a cleanup upon completion."

Some idea of amount of work may be derived from the following figures taken from the numerical reports of work done, cost and bills:

The amount received from contractors and others for repairs to asphalt pavements was....	$4,249.09
General bills for repairing and cleaning streets, work done and supplies furnished, 11 months, to Dec. 1, 1914.....	15,111.43
General bills for repairing and cleaning sewers	1,757.58
Interdepartment bills for cleaning and repairing streets.....	4,467.14

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Inter-department bills for cleaning and repairing sewers.....	61.78
Amounts received from contractors and others for work done by the department for them were as follows in maintenance:	
Departments	17,781.63
Planked streets.....	1,143.95
Dirt streets	652.99
Sidewalks	1,817.77
Sewers and drains.....	1,819.36
The inspection division released guaranty deposits for use of streets amounting to.....	15,530.75
Permits issued to franchise holders for street work.....	235
Sewer extensions inspected.....	309
Orders to backfill sewers.....	179
Permits issued for sewers.....	1,948
Permits issued to repair sewers.	52

Sir—In your issue of January, 1915, an article appeared relative to "Ordinances Regulating Street Excavations." I am sending you a copy of an ordinance regulating these matters in our city and wish to say that this ordinance has given good satisfaction here, both to the gas and water companies and plumbers, as well as to the public.

ELMO A. FUNK,
City Engineer, Anderson, Ind.

Ordinance No. 811.

An ordinance to regulate the digging of trenches and other excavations in the public streets, alleys and sidewalks of the city of Anderson, Indiana, and providing penalties for its violation.

Section 1. Be it ordained by the common council of the city of Anderson, Indiana, that hereafter it shall be unlawful for any person, firm, or corporation to dig any trench or to make any excavation of any kind whatsoever in any of the public streets, alleys, or sidewalks of the city of Anderson, Indiana, without first obtaining a written permit from the city engineer to do so.

Section 2. For the purpose of obtaining such written permit the person, firm or corporation desiring the same shall file with said city engineer a statement in writing to be signed by such applicant in the condition that same was in before such trench or excavation was made. Such estimate shall be made by the city engineer and the amount estimated therefore shall be paid by the applicant to the city controller, and his receipt therefore shall be presented to the city engineer, who shall then issue such permit. As soon as such trench or excavation is ready to be refilled the person, firm or corporation to whom such permit was issued shall immediately notify the city engineer, who shall cause the same to be refilled and resurfaced by street committee of said city under the direction and supervision of said city engineer. That portion of said deposit not required, to refill such trench or excavation shall be returned by city controller to person paying same.

Section 4. Anyone violating provisions of this ordinance shall be fined in any sum not less than $10.00 nor more than $25.00. This ordinance shall be in force and effect from and after its passage and publication as required by law.

Disposal of Garbage and Refuse in Seattle.

The Editor of MUNICIPAL ENGINEERING:

Sir—Your communication addressed to Mr. A. H. Dimock, city engineer, regarding disposal of waste has been referred to this department for reply.

We are at present disposing of our garbage and waste by making sanitary fills, or at least of all but sixty-five tons per day, which is incinerated. This is light material and such as would be difficult to dispose of at the present fills on account of their location.

This method of filling works very satisfactorily in this climate, but I believe it is necessary to include all waste materials, as ashes, boxes, tin cans, etc. These all assist oxygenation and nitrification. I do not believe pure garbage can be handled in this way.

We also find that it is best to keep as little of the face of the fill exposed as possible. It is always best to keep a man constantly on the job, whose duty it is to rake down to the bottom of the fill all boxes, rough materials, etc., thus leav-

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these fills make no complaint, but the public has to be educated when you first adopt this method. We aim to fill city property, as ravines, swampy land or docks on the lake or salt water front.

Enclosed find copy of our laboratory findings, which will show that the process is simply one of slow incineration by nature instead of the expensive method of burning by incinerators, and at the same time will help to prove that there is nothing detrimental to public health in these fills.

We have eleven fills distributed over our city, thus making short hauls, and these are taken care of by eleven laborers, disposing of approximately three hundred and fifty tons per day by this method alone, while one incinerator with about an equal pay roll will only dispose of sixty to seventy-five tons per day, running twenty-four hours. A fill increases the value of property, while the refuse from our incinerator has to be hauled away at an added cost.

J. S. McBride,
Seattle, Wash.

Following is the chemist's report referred to:

Results of chemical examination of samples of "garbage borings" submitted to this laboratory for examination:

Three months old:

Sample Number	Moisture, Per Cent.	Organic Matter (Unburned Coal), Per Cent.
1.....	26.17	16.26
2.....	24.29	18.79
7.....	29.86	10.02

The samples as submitted consist almost entirely of the ash of coal carrying considerable moisture and some organic matter in the shape of unburned coal.

The samples carry only traces of decomposing or fermentable organic matter.

Six to eight months old:		
3.....	29.40	8.79
4.....	24.90	7.80
5.....	32.46	9.10
6.....	33.03	10.02
One year old:		
8.....	15.00	12.41
Eighteen months old:		
9.....	8.33	7.32

The organic matter in the above samples consists almost entirely of carbon or unburned coal.

The samples contain very little of a fermentable or decomposing nature.

The decomposing matter in the above samples would in all probability not amount to over 0.1 per cent.

A. Jacobson,
City Chemist.

Graphic Methods for Presenting Facts

The science of presenting facts to the eye so that they will impress the mind of the non-scientific observer more clearly, has developed rapidly of late years. For many years this method of making comparisons was open only to the trained mathematician, but now the mathematics are all taken out of it as to the reader or observer and the making of the graphical charts is largely reduced to rule.

There are suitable and unsuitable methods to use, however, and the clearness of the exposition of the subject illustrated depends upon the proper selection of the method. Then, too, it is quite easy to give wrong impressions by improper manipulation of graphical methods, even if the exact facts and only the exact facts are shown.

The science, as it has been developed today, is fully set forth in Willard C. Brinton's book on "Graphic Methods for Presenting Facts," which fully explains the uses of various simple graphical devices and the misuses often made of them.

The principal devices described are the horizontal bar, the circle and sectors, separate bars, horizontal or vertical, totaling 100 per cent., charts giving numerous subdivisions, organization charts, routing charts.

Simple comparisons of quantities of one, two or three dimensions are made and various methods of making such comparisons are compared and contrasted, showing when they are suitable and when not. The plotting of curves to show continuing processes or provisions of facts, with full discussions of the proper units to use in making the drawings, occupies several chapters. The explanations are so full and clear that the unmathematical reader can learn to understand the showings of the curves if not to construct them himself. The mathematical reader has a full treatise on the tools thus put into his hands which should make him expert in showing facts by graphical methods and in making true comparisons

Maps and varieties of shading to show various kinds of information are fully described and illustrated.

General methods for collecting and tabulating data in order to get them into understandable form, preparation of charts, instructions to engravers in reproducing them for publication, making of titles, statement of scales and of relations of them to each other; in short, all the details from the selection of facts to collect to the publication of those facts in printed form are given in full detail and clearly so that any one wishing to avail himself of the graphical methods of presenting facts will find full instructions for all steps in the process.

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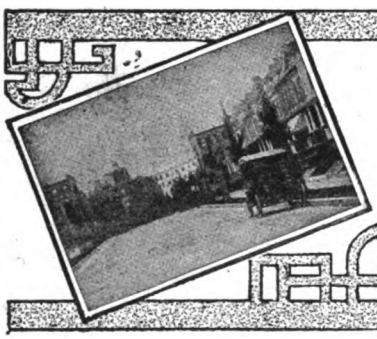

ROADS AND PAVEMENTS

Tests vs. Inspection of Treatment of Creosoted Wood Paving Blocks.

A Paper by Frank W. Cherrington, Engineer for Jennison-Wright Co., Toledo, Ohio, before the American Wood Preservers' Association.

Is the collection and analysis of creosote oil, extracted from creosoted wood paving blocks after treatment, a reliable calculation as to the initial quantity actually injected inside the blocks, during the process of treatment?

The desired degree of accuracy, relating to the average quantity of injected creosote oil per cubic foot of timber, cannot be reached by the laboratory extraction and analysis of creosote oil, after its injection into wood.

Owing to the remarkable variation in the structure of wood it is only possible to determine accurately the average quantity of creosote oil injected per cubic foot of timber, by close observations of the proper treating gages and automatic feeding devices at the creosoting plant during the actual process of treatment.

The composition of the timber is of so complex a nature that scarcely two wood paving blocks are identical in structure, even when cut from opposite ends of the same plank of average commercial length. This is true, regardless of the most careful commercial specification as to lumber, limiting the percentage of heart-wood, number of annual rings to the inch, etc. Therefore, altho treated under the same temperature and same pressure, scarcely two wood paving blocks will have the same degree of penetration or absorption.

The reasons for the variation in the tree and some from the exterior portions of the tree. The even dry weight of sapwood is often but two-thirds that of the heart-wood. A cross section of a truee cut from its base will be of an entirely different structure from the cross section cut from the middle or top. Timber growing on the side of a hill will be different from that growing on high or low ground. Some trees will grow at the edge of the forest and others in the interior. A piece of timber cut from the north side of a tree will show a different structure from that cut from the south side. A rapidly growing tree will have a different structure than that of a slow growth timfer of the same species. Thus it is seen that environment is largely responsible for the complexities in the wood structure of a tree.

A quotation from Bulletin 101 of the Forest Service, United States Department of Agriculture, relating to "The Relative Resistance of Various Conifers to Injection with Creosote," follows:

"It is very difficult and sometimes apparently impossible to secure uniform treatments of wood with preservatives. If, for example, an average treatment is given of ten pounds of creosote per cubic foot, some pieces of wood in a charge will take twice the average amount, while others will receive less than half of it."

An average carload of creosoted wood paving blocks will contain approximately 300 square yards, or 15,000 individual blocks. The chemist in making analysis after the blocks are treated and have arrived on the work, selects perhaps a dozen, but rarely two dozen, blocks from the car at random. The creosote oil is then extracted and analyzed as to both

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pine was found to be erratic in its penetration and absorption of creosote."

The above citation from the government, and the listing of but a few of the factors affecting the structure of wood, prove the futility of selecting a few wood paving blocks for analysis, after the injection of the oil, as representative of the average penetration and quantity of oil that may be secured on the entire car. The blocks selected for analysis may be all heart or all sap, with large or small quantities of resin, etc., and the chance of a wide deviation from the true average is great.

The final result obtained from a laboratory analysis is liable to be in error. The human element, volatility of the creosote oil, difficulty in separating the injected creosote oil from the natural resin, impossibility of extracting all of the injected oil, etc., etc., all tend to reduce the precision of the result. The possibility of an error in laboratory extraction and analysis, combined with the variation of the wood structure, doubles the chance for inaccuracy and detracts from a precise estimation of the average amount of creosote oil initially injected into the wood.

Records showing the average quantity of creosote oil actually injected into the wood blocks at the plant during the treatment, when compared with the results showing the amount of oil extracted by laboratory analysis from selected samples, representing an exceedingly small proportion of the entire number of blocks treated, will naturally show a decided variation.

When laboratory analyses are accepted by the consumer as absolutely conclusive, regardless of whether or not an inspector has been present to check the actual injection of the oil at the plant, creosoted wood blocks are often rejected, when the manufacturer has conscientiously and closely followed the required specification.

Directly bearing on this subject, is the following excerpt taken from a report by Wm. W. Marr, assistant engineer of streets, Board of Local Improvements, Chicago, Ill., entitled "Repaving the 'Loop' District in Chicago with Creosoted Wood Blocks," which, of course, anticipates a proper selection of the timber, oil and treatment, in accordance with good practice:

"Many blocks, on being split for the purpose of making mitres or closures, show white on the inside and appear to have received very little treatment. This is a cause of a great deal of complaint from those who are not familiar with the balance of the blocks received; so it can safely be assumed that the blocks which do not show so great a penetration as the rest are simply incapable of taking the oil on account of their pores being already filled with resin. Blocks of this sort have never given any trouble and are consequently never rejected."

Modern creosoting methods employ the treatment at one time of some thirty thousand (30,000) individual, and very different paving blocks. These are placed in the same creosoting cylinder and subjected to the same temperature and same pressure. It is impossible to give each block an individual treatment, and since blocks of varying structure must be treated collectively, it is but consistent to insist that an extremely small proportion of the whole, selected at random for analysis, cannot be conclusively indicative of the average absorption secured by the treating plant engineer on the entire charge.

Supply and Use of Water in Concrete Road Building

From a Paper by C. D. Franks Before the Indiana Engineering Society.

It is often the case that a concrete roadway or other hard surfaced road is to be placed upon an old roadway, when the new road is wider than the old roadway has been. Where such a condition exists it will be necessary to loosen thoroly the old roadway for quite a distance below the desired surface of the finished sub-grade, this distance to depend upon soil and other local conditions. The entire fill should then be made and compacted uniformly, the object being to provide a sub-base of equal bearing power thruout, for when one part of the foundation of a hard road surface is less apt to settle than another, it is impossible to do away with cracking. A special example may be cited in the case of a hard surfaced road which is to be laid at a greater elevation than the old roadway, where the old roadway was on a considerable fill. As the new roadway will rest upon a fill deeper than the old, the width of the fill at the bottom will be proportionately greater. To obtain a uniform bearing surface, therefore, the material in the old fill should be spread out uniformly in a layer from one side of the new slope to the other and the rest of the fill be placed on top of it. The greatest care is necessary in building any fill of greater depth than two feet so as to

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to exceed one foot in thickness, and should be thoroly rolled before succeeding layers are placed. If soil conditions permit, it will be well to settle this fill with water in addition to or instead of rolling. By far the better practice would be to build the fill in the fall of the year previous to that in which the roadway itself will be laid. In this manner many unnecessary cracks can be avoided.

There is a simply made tool which can be used to determine the slope of material in a fill. It consists of three boards—one horizontal, one vertical and one inclined, making an angle with the horizontal piece equal to the required slope of the material. From the horizontal board a plumb-bob is hung and vertically below it on the inclined board a mark is made. This gage is placed with the inclined board along the slope. If the side surface of the fill corresponds to the required slope, the plumb-bob will hang directly over the mark on the inclined board.

It should hardly be necessary to state that it is extremely bad practice to make a fill with frozen materials, yet one or two cases of this kind have come to my attention. When frozen material in a fill thaws it compacts greatly under its own weight and the surface of the fill settles considerably; invariably enough so that no hard surfaced road can stand upon it without cracking.

It sometimes becomes necessary, when grading, to set a stake on one side of the roadway at the same level as that on the other side, when a level is not at hand. This can be very simply accomplished by completely filling a piece of hose with water. By holding one end of the hose so that the water showing in it is just level with the top of the stake of known elevation, and setting the stake on the opposite side of the road at the elevation of the water at that end, you can be sure that the second stake is at the same elevation as the first, the hose acting as a siphon in case the roadway between the stakes is higher than the stakes.

CONCRETE MIXER which must be *supplied with water regularly, and in sufficient quantity.*

The water supply for the construction of a concrete road and pavements is always a problem, if handled economically and satisfactorily The necessity of an adequate supply may be surmised from the fact that the sprinkling of the sub-grade before concrete is laid, the mixing of the concrete and the sprinkling of the finished concrete surface for curing, will require on an average of 13,000 gallons per day, when 500 square yards of concrete pavement are laid. In rainy weather or in the fall of the year the sprinkling may be unnecessary and this amount of water may be materially reduced, but it is unsafe to provide for any smaller amount than 25 to 30 gallons per square yard of concrete laid in the summer months, for an inadequate supply will materially hamper the work, delay the job and increase the contractor's cost.

The volume of water required at the mixer is the same whatever the size of the supply pipe may be. In order to supply the same amount of water the velocity in a small pipe must be greater than in a larger one. But friction increases as the square of the velocity, and therefore the loss of head in a small pipe is much greater than in a larger one. In practice it is rarely found advisable to use less than a 2-inch pipe line to supply water to a concrete road or pavement job, and no connections smaller than 2 inches should be used. Where two sizes of pipe are used, the contractor may have laid his smaller pipe nearest the pump or source of supply before the larger size pipe is secured. He has in one or two instances considered it necessary to place the larger size nearest the supply. This necessitates, of course, that the smaller pipe be carried ahead to the end of the larger pipe, which may be in some instances as much as a mile or two in length. This is unnecessary, as the total friction will be the same whether the larger or the smaller pipe is nearest the supply, tho the smaller pipe may be eliminated sooner from the line if it is laid farther from the source.

It frequently becomes necessary to take a section of pipe from the pipe line to re-

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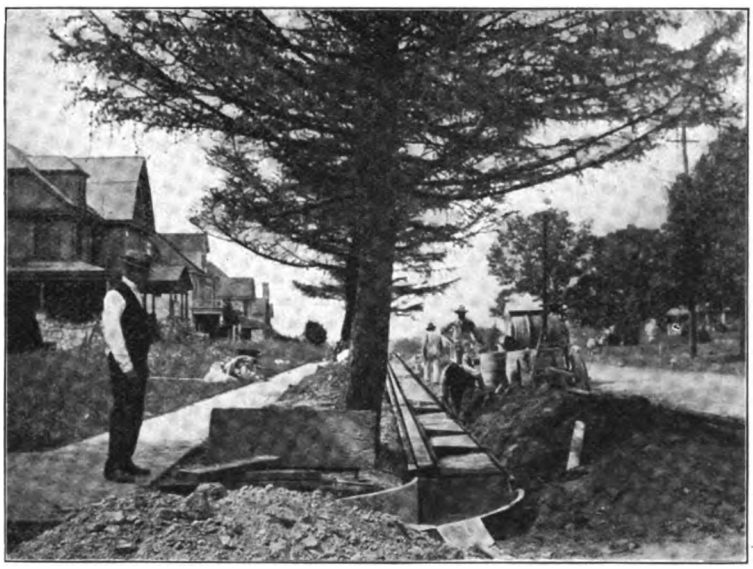

LAYING CURB AND GUTTER *with water supply to concrete mixer furnished in barrels, quantity required being much less than for pavement.*

short for the same reason, so that it will be well to space the T's and taps not farther than 200 feet apart. Pipe for the water line should be procured in as great lengths as can be economically handled, to lessen the labor of connecting.

When the water is taken from a poor or other natural source, the intake should be protected so that sticks and other foreign matter will not be drawn into the pump and pipe line, where they will cause trouble. When the water supply is taken from a city main it will sometimes be advisable to use a booster pump to obtain a sufficient head for the requirements of the job. In many cases it is possible, when constructing pavements in cities or towns, to connect directly by means of a suitable hose to water hydrants. However, it will be found more economical in a great many cases to be provided with a line of pipe, in order to insure at all times the proper delivery and amount of water required to carry on the work satisfactorily.

Some sort of relief valve must be used in the pipe line so as to prevent the breaking of the pipe or the blowing out of the cylinder head in the pump when it is running but no water is being used. Spring relief valves have been used with success, but a simple arrangement may be used to take their place. At one of the T's previously placed in the pipe line near the mixer, insert one or more lengths of pipe vertically upward. The top end of this pipe will be open and this arrangement will act as a relief valve. If the outflow of water at the mixer is stopped, the pump, instead of exerting pressure against the water confined in the pipe, can raise the height of water in this improvised standpipe and any excess may be allowed to flow thru the upper open end of pipe. This arrangement acts as a relief valve and also assists in procuring a uniform pressure of water at the mixer at all times. This is always desirable and materially helps in obtaining a uniform consistency of concrete delivered by the mixer. This standpipe should be moved frequently so as to be always close to the mixer.

Like all other things, the pipe line will expand and contract with changes in temperature, and unless some provision is made for this expansion and contraction, rupture is apt to occur. For this reason, expansion joints of some kind must be placed in the pipe, preferably at distances not to exceed 2,000 feet. The copper expansion joint is a standard fitting and is often used for this purpose, or a satisfactory expansion joint may be formed by three sets of fittings, consisting of two elbows and a nipple, so placed as to make a "V" in the pipe line. Another satisfactory method is to offset the end of one pipe from the other slightly—say a distance of six inches. These two ends should then be connected with a rubber hose. Connections of this hose with the pipe must be tightly made in order to prevent leaks, and the hose should be of a size at least equal to that of the pipe to

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reduce friction, which will be naturally greater where the water is forced thru any bend. Sufficient hose should be used to provide for a movement in the pipe of six inches.

The character of the sub-grade for roads or pavements is sometimes such that sprinkling immediately before placing the concrete results in a muddiness which is detrimental to the work. At the same time, if concrete is placed upon such a sub-grade without sprinkling, the thin mortar will be withdrawn from the concrete and thus prevent its hardening or weaken it. Therefore, it may sometimes be necessary thoroly to sprinkle the sub-grade before the aggregates are placed upon it, so that it will be moist but not muddy when concrete is deposited. Necessity for this early sprinkling can only be determined by an investigation and possible experiments with the particular sub-grade in question.

One of the things which has required the greatest attention in the past is the water supply to the drum of the mixer, so as to obtain a uniform consistency of the concrete. No method should be used which does not automatically supply each batch of materials with the proper amount of water. This makes the use of a measuring device for water, which is positive and quickly adjustable, a necessity. Contractors who are considering the purchase of a mixer, or engineers who are passing upon a mixer to be used upon concrete road work under their supervision, should thoroly investigate this most important part of the equipment—the automatic measuring tank for water.

One of the most difficult things to provide for in specifications is a thoro mixing, because of the different shapes and positions of the mixing drum and blades, as well as the speeds at which the drums revolve on the different makes of mixers. The only satisfactory way to write a specification that will cover all types of mixers is to specify two minimums; one the minimum number of revolutions per minute and the other the minimum time of mixing a batch. A recent device for automatically recording the number of revolutions per batch was on exhibition at the sixth annual good road show, held in Chicago during December, 1914. An indicator was placed on the side of the mixer which could be set to the specified number of revolutions. When the unmixed materials were placed in the drum, this indicator automatically recorded the revolutions of the mixer and at the proper number a bell would ring, indicating to the man at the discharge end that the batch was ready to be removed from the drum. This device is a great step forward in the proper mixing of concrete, for, by determining the r.p.m. of the drum, setting the indicator properly and following the signal given by it, thoro mixing is insured.

The Utilization of Short-Term Convicts for Highway Work in Georgia.

From a Paper by James Leland Stanford before the American Association for the Advancement of Science.

To secure accurate data a questionaire was submitted to persons actually engaged in working misdemeanants on the roads in every county in Georgia. The results obtained are presented in a condensed form in this preliminary report. They give the viewpoint of citizens and officials in Georgia and, being uncolored by outside influence, are of great value.

The State Prison Commission reports that practically all of the misdemeanant and felony convicts, with the exception of the women and those in poor health, are employed in some phase of highway work, 2,441 misdemeanant and 2,740 felony convicts being worked by 124 counties during 1914.

Cost of Equipment for Road Gang.

Camp Equipment.	One Unit.	Two Units.	Four Units.	Six Units.
1. Winter barracks, including guard room	$140	$200	$240	$300
2. Cook room	25	25	25	25

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Comparison of Increased Cost of Dividing Gangs.

Camp Equipment.	One.	Two.	Four.	Six.
Cost of separate 1-unit gangs	$500	$1,000	$2,000	$3,000
Cost of separate 2-unit gangs	600	1,200	2,400	3,600
Cost of separate 4-unit gangs	800	1,600	3,200	4,800
Cost of separate 6-unit gangs	1,000	2,000	4,000	6,000

Road Machinery and Road Working Equipment

For a 2-unit gang, earth and sand clay construction:

1.	Large 6-horse grader	$255.00
2.	Two-horse grader	110.00
3.	Large rock or rooter plow	35.00
4.	Rock plow	20.00
5.	Five drag scrapes	36.00
6.	Four wheel scrapes	240.00
7.	Four 2-horse wagons	260.00
8.	Ten large mules	2,250.00
9.	Five sets of double harness.	100.00
10.	Hammers, shovels, picks and axes	74.00
	Total	$3,350.00

Size of a Road Gang Under Ordinary Conditions.

Regardless of the kind of work undertaken by a convict gang the annual interest on the first cost and depreciation of the equipment and the annual expense of maintaining the convicts must be considered. The economical solution is to so adjust the size of road gang as to render the sum of these factors a mimimum.

Cost of Maintenance Per Convict Per Day.

	One Unit.	Two Units.	Four Units.	Six Units.
1 Physician	0.111	0.055	0.027	0.019
1 Warden	0.132	0.066	0.066	0.022
1 Day guard, per unit	0.066	0.066	0.066	0.066
1 Night guard, per camp	0.066	0.033	0.016	0.011
Food	0.250A	0.230B	0.204C	0.168D
Clothing	0.106	0.100	0.095	0.091
Depreciation	0.075	0.028	0.025	0.021
Interest on first cost of all kinds of equipment	0.058	0.022	0.020	0.016
Total cost per day	0.865	0.600	0.519	0.414
Actual practice plus interest	0.850E	0.559B	0.446C	0.395E

Based on salaries for month: physician $50.00, warden $60.00, each guard $30.00, rate of interest, 6 per cent.

(A) F. F. Hill, Homer, Ga.
(B) J. C. Redman, Butts Co.
(C) E. H. Myres, Ware Co.
(D) V. O. Morgan, DeKalb Co.
(E) Average of several similar reports.

According to reports received and actual experience, which may be said to have passed the experimental stage, a guard can most economically and advantageously handle fifteen men. Fifteen men per guard under ordinary local conditions in the Southern Eastern states has, therefore been chosen as a unit. And it is suggested to the engineer, who is planning a county gang, to make the gang some multiple of fifteen, if he would secure the greatest efficiency per guard and the greatest efficiency per gang. The size of a gang varies in numbers according to the wealth and population of the county, as each county works its own misdemeanants. In exceptional instances only should a road gang be less than two units or thirty men, as the expense per man has been found to increase rapidly when the number is smaller.

The number of units composing a gang should be proportionately determined by such factors as the expense per man; mileage of roads to be constructed and repaired; the character of the work to be done; the class of men in the gang; and the equipment provided.

One engineer reports that in heavy cuts and fills gangs work efficiently up to seven units. For ordinary construction work on county roads, some distance from a base of supplies, experience has proved it more economical to divide a gang when it exceeds appreciably six units.

The expense per man both as to food and guarding at night increases rapidly as the number of men in a gang falls below thirty and decreases just as rapidly as the gang increases by units up to a certain limit. One night guard can handle a camp of ninety convicts quite easily, since the day guards sleep nearby and are ready to give him assistance at anytime. Moreover, men who work on the roads all day hardly need a guard at night. When a four-unit camp is divided into two camps of two units each, an extra night guard and an additional warden must be employed, since the law requires a warden to each camp.

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The guards act as road foremen, hence the expense of employing foremen is obviated and balanced by guard hire. The guards should be hired at a stipulated amount and their wages gradually raised as they become more efficient foremen.

In a great many instances it has been found economical to use certain mechanical appliances as labor-saving devices. Mules are generally used for traction in the construction of sand-clay roads, because they can be utilized in places which would make other forms of motive power impracticable.

As yet very little evidence has been presented as to the economic use of mules for road work, and a policy will merely be outlined, which may be considerably modified before a conclusion is reached in the matter. Not only the use of mules, but other forms of traction will each be considered in the final report on this subject. It is evident that the cost of hauling on the ten-mile basis bears a fixed relation to the cost of running a convict camp economically.

The efficiency of a gang in constructing sand-clay roads depends upon the number of mules per gang; within certain limits, "one mule per man is best usage" and secures the greatest amount of efficiency per gang. The mules are usually worked in teams and are hitched to the various appliances used in road work. A great deal of hard labor and valuable time is saved thereby.

When the number of mules drops appreciably below half the number of convicts composing a gang, the efficiency of the gang will become so low that convict labor ceases to be economical and the county will lose money on the job.

When the number of mules appreciably exceeds the number of convicts composing the gang, the number of trusties and the mules operating the machines will be exhausted. It is not a good policy to hire free labor to operate the machines, because of the increased expense and the likelihood of friction with the convicts.

Charleroi Paving Bonds Sold

Twenty-five thousand dollars worth of the $75,000 issue of bonds, authorized at the recent election in Charleroi, Pa., have been sold by Charleroi council to the Holmes-Wardrope Company, of New oYrk City. The bonds are to bear 4½ per cent. and are to mature in thirty years. Together with the selling of the $25,000 bonds, an option was given on the remaining $50,000, to hold until April of next year, at the same figure.

Third street will be the first street given attention. The boro engineering corps is requested by the council to prepare a grade and to arrange all preliminaries for the paving of the street during the winter, so that the contract can be awarded and the work of paving actually started at the earliest possible moment next spring.

This sale shows that there is full confidence in municipal bonds and that there is money ready to invest in long-time municipal bonds at reasonable rates.

The Boro of Charleroi is enabled by this sale to take advantage of the present prices for materials and thus to obtain lower figures on contracts let at this time than will be available later in the year. The only exercise of judgment required of the contractor in bidding at this time is as to the future price of labor.

Increased Popularity of Municipal Bonds

One of the safest and wisest forms of investment today is that of municipal bonds. The average investor is probably less familiar with this class of securities than with corporation bonds, because in the past the relatively smaller income obtainable on them has led to a broader investigation of, and a more popular investment in, those securities paying the higher rate of interest. Their greater safety, however, has never been disputed, but been amply confirmed by the higher price levels which they have always enjoyed.

In recent years increasing attention has been given to this form of security by private investors, whereas formerly the markets for such bonds has beve been principally confined to eavings banks, insurance companies and trust estates. The explanation for this was in many instances individual prejudice, and, also, as previously stated, because the rate of income had been less than that which it was possible to obtain from corporation bonds. In contrast with the present timidity about purchases of corporation securities there is a conspicuous feeling of confidence toward municipal bonds. About a year ago marked the beginning of a new and favorable sentiment toward them, occasioned principally by the passing of the income tax provision in the new tariff law. This law, exempting municipals from the income tax, focused the attention of investors upon the merits of municipal securities, and has resulted, not only in a broader market for them, but many holders of corporation stocks and bonds have been disposing of some part of those holdings in favor of public, tax-exempt bonds.

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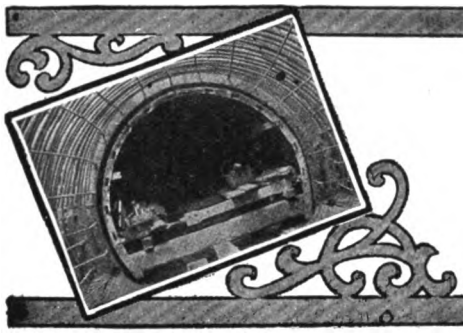

SANITATION

Inoffensive Sewage Disposal

By Rudolph Hering before Section D of the American Association for the Advancement of Science.

SEWAGE is dirty water and contains very roughly one part of dead organic matter and one part of mineral matter to between one thousand and five thousand parts of water. It is only the organic matter which concerns us here, some of which is unstable, breaks down quickly and may putrefy within a day, such as certain animal and vegetable liquids, and some is stable and decomposes very slowly, such as hair, wood fiber, epidermis, cartilage and the like. The unstable matter alone usually causes all the nuisance arising from sewage. It has but a slight resistance to decomposition. It first absorbs oxygen with avidity to form more stable compounds; these have no offensive odor of themselves nor do they produce gases with foul odors. Then, when the conditions have become such that oxygen for absorption is no longer available in the medium holding the unstable matter, other chemical processes become active, producing chiefly hydrogen compounds. Among the latter we have those which produce foul smelling gases and others which do not.

In view of these facts and in order to prevent offensive consequences, the practical engineer is obliged to place the sewage from first to last under conditions that permit of its being collected and carried quickly and completely from the points of origin to those of final disposal, and delivered at the latter points before the available oxygen in the sewage water can be exhausted. He is also obliged to provide means to facilitate decomposition by contact with oxygen, so far as practicable, and in its absence by such combinations of hydrogen as will produce no offensive odors.

All of the processes of sewage decomposition are accomplished chiefly by the presence of certain bacteria, which in their activity produce gases, some of which are offensive and some are not. We are here concerned only with those ways and means which will avoid the evolution of offensive gases.

Let us first consider the works for collection and delivery of the sewage with respect to achieving these desired results.

Our wash and bath rooms, toilets, kitchens, laundries, etc., are now supplied with fixtures in such a manner that offensiveness can be entirely excluded. This is done simply by giving them forms and surfaces upon which the dirty water can flow away quickly, no solid particles remain on the surfaces and a final flushing with clean water will restore the receptacles to their condition before use.

¶ VENTILATION *of house connections and free and rapid flow of sewage in them are essentials.*

The pipes carrying into the sewers the sewage thus generated should likewise carry it away quickly and completely. The means for accomplishing this are, first, smooth and evenly curved and jointed pipes, and, secondly, good currents of air circulation. The former prevents catching, retention and consequent putrefaction of solid particles, the latter tends to clean up the exposed surfaces which are otherwise usually covered with slimy growths. This air circulation is automatically established by providing openings to the sewer from the street surfaces, and openings to the house pipes above the roofs of buildings.

There was formerly strong opposition, particularly in England, to street sewer air passing up thru the house pipes to the roof. It was feared that street sewer air might enter rooms thru imperfect pipes or thru the fixtures if their traps were not in order. This opposition is still generally maintained. On the European continent and in many American cities,

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the ventilation of street sewers thru house pipes has, however, been found very advantageous. The house pipes are kept much cleaner, the slimy coating is largely removed and the escaping air above the roofs is less odorous than when the house pipes are trapped at the bottom against the street sewer. A careful examination made in this country proved that the escaping air from house pipes contains practically no disease germs or other bacteria.

After the house sewage enters the street sewers it should be kept flowing without any interruption. This result is readily attained if the sewers are designed and built with reference to this end. The surfaces again should be smooth. Vitrified clay pipes, used for small sewers more than any other kind in this country, have the smoothest surfaces. Yet the inevitable projections at the joints, due to the manufacture of the pipes, reduce this advantage to some extent. In practice, therefore, the pipes are laid so that there is no projection at the bottom, upon which the sewage flows, and which would retain solid matter, but all of the projections are at the top. Cement pipes can be made almost as smooth as vitrified pipe and have no projection at the joints. Concrete sewers have the same latter characteristics. Brick sewers furnish the roughest surface, even if the joints are carefully made and the bricks are of the best. With good flushing and brushing down at proper intervals even brick sewers may be kept in such a condition as to entirely prevent offensive odors from generating therein.

Other important elements as regards odor production are the junctions of several sewers. They must always be made so that the sections above them are gradually and not suddenly merged into the sections below them, which construction prevents eddies and deposits resulting in putrefaction and odors.

¶ VENTILATION *of sewers themselves and systematic flushing are also essential.*

Finally, to preserve an inoffensive condition in sewers, we must establish within them a systematic ventilation and flushing.

Ventilation is generally secured by the natural differences of temperature existing in various parts of the sewer system. It has been found best to let the air circulation take care of itself, by providing the necessary openings, ample in size, for the air to enter and others for it to escape. It happens sometimes on cold days that the air circulation is in the opposite direction to that on hot days. This reversal of current is not objectionable if the sewers have no foul deposits in them and if the ventilation has at all times been free and ample. Artificial ventilation was thought necessary in former times and numerous contrivances were introduced. Today, after long experience, it is known, when sewers are properly designed and built, and properly cleaned and flushed, that natural ventilation is entirely sufficient and satisfactory.

Flushing is another important requirement for the sewers to prevent offensive odors in them. Above ground, within our houses and on our bodies, we use ample amounts of water for cleansing purposes. Below ground in sewers, ample flushing is equally and even more necessary, due to the relatively greater concentration of unstable decomposing organic matter. Unfortunately in our country the finishing of sewers has not been given as much attention as is desirable. In almost all European countries, both small and large sewers are flushed frequently, varying from several times a week to once in one or two months. The results of this frequent flushing are very satisfactory and the money is willingly appropriated.

In our country, particularly in smaller cities, we have extensively introduced automatic flush tanks at the heads of all pipe sewers. While these tanks keep the upper ends of the sewers clean and free from deposit in a very satisfactory manner, they do not keep the larger sewers lower down the line free from deposits and odors. In this respect our sewer systems could be greatly improved and the odors therefrom materially diminished.

¶ PUMPING *for a low lift,* AERATION, *and* SCREENING *at various points in the system are suggested as methods of reducing nuisance from sewage at end of long slow flow.*

When collecting sewers are long and the distance to the outfall is great, which fact is generally associated with flat grades and slow velocities, we have almost always some putrefaction and offensive odors arising near the lower end. During the long run the oxygen has become exhausted and hydrogen compounds, notably sulphureted hydrogen, are developed. The obviation of this condition may be secured by emphasizing several remedies above mentioned. For instance, the surface of the sewer should be made especially smooth, means might be employed for a more thoro flushing than would otherwise be necessary and the grades and sewage velocities might be improved by the introduction of a low lift or booster pumping plant.

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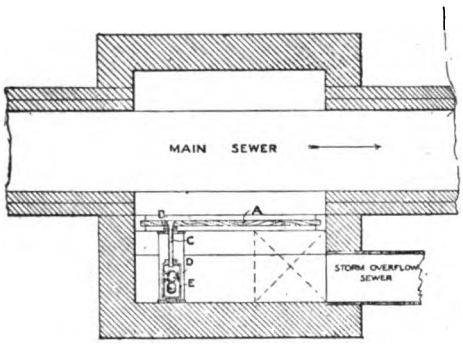

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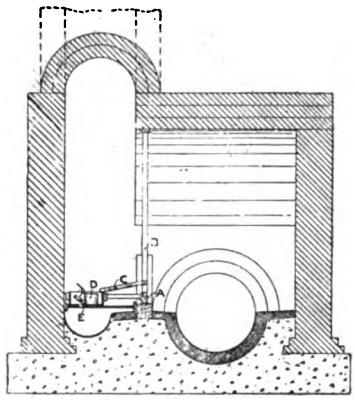


— SECTION —

DESIGN *for storm overflow sewer and setting of apparatus for taking sample of sewage or storm water at any height for which it may be set.*

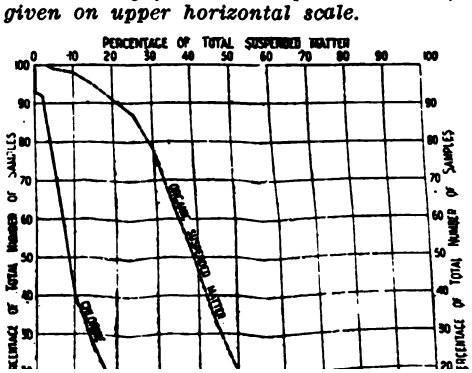
Still another expedient might be practicable, by replenishing thru artificial aeration the dissolved air, from which the oxygen has been exhausted and putrefaction has been initiated. Experiments have been made recently both in England and America to accomplish this purpose and have resulted in more or less success. Where it is possible to force air into a sewage pumping main, under a pressure of at least one atmosphere, good results have been obtained with the sewage after its discharge into a sewer. Distributing air into the sewage within the flowing section and under ordinary pressure seems as yet to have given only moderately good results.

There is one more means by which the fouling of sewage on a long run can be reduced and incidentally also the expense of the final sewage treatment. When we consider that but very little of the organic matter which is discharged into sewers at the house is dissolved, and that about one-half of it is dissolved when the sewage reached the outfall of an average city, and also that dissolved matter withdraws oxygen from the water more quickly than the solid matter, we must conclude that a removal of solid matter by fine screening or short-time deposition higher up the sewer, before much of it is dissolved, would be of benefit. A number of small settling tanks near the beginning of the main sewers might, for instance, not only prevent foul odors near the lower districts, but prevent also the necessity and expense of works for oxidizing the amount of dissolved organic matter which is thus eliminated.

success the apparatus which is described as follows:

Altho the existing sewers are relieved by storm overflows, they work under a head of water in times of storm. Many local and tributary sewers also become surcharged during periods of heavy rain, chiefly owing to the insufficiency of the

DIAGRAM *showing pretrescibility of storm water overflow in sewer. The full line shows the percentage of the total number of samples containing the various amounts of chlorine, given on the lower horizontal scale. The broken line makes like showing for total suspended matter, given on upper horizontal scale.*



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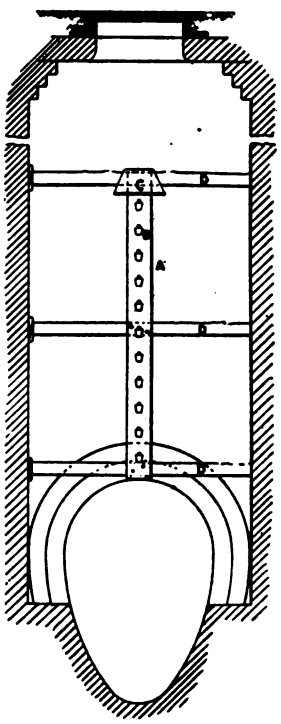

SMALL TIN CANS B *on the board A by filling as water rises show height to which sewage rises in manhole, thus giving the maximum rate of flow of sewage between observations.*

main sewers into which they discharge.

In Manchester there are upwards of 200 storm overflows, and no two of these are exactly similar in construction. As the main drainage work proceeded and the old seyers were exposed, an accurate survey was made and detail drawings prepared to meet the conditions found in each case.

It was necessary to ascertain the character of the diluted sewage passing over the sill of each overflow at the beginning of a storm. In a town where there are a number of overflows it is obviously impossible to take the samples by hand. A simple and cheap arrangement for securing these samples was therefore devised (C), leading the storm water to the sampling apparatus, which consists of a receiver (D), fitted with a heavily weighted lid; from the back of the latter a wire projects to which is attached a cork; the whole apparatus is placed in a strong wooden box or cistern (E).

The receiver (D) is closely covered with an airtight joint when the lid falls. The cost of this sampling appliance, fixed complete, is under a sovereign ($5).

The following diagram (Fig. 3) shows the putrescibility of the samples taken at the sill level of the storm overflows in the city, arranged in order of grains of chlorine per gallon, this being considered an index of the putrescibility. The percentage of organic matter in the total suspended matter is also indicated on the diagram. It will be observed that only a comparatively small percentage of the samples taken have high chlorine figures or a high percentage of organic matter.

For the purpose of obtaining accurate particulars of flood levels in sewers, the arrangement shown by Fig. 4 has been successfully employed in Manchester.

The device consists of a board (A) placed vertically in the manhole shaft to support a number of small tins (B) placed at regular intervals. These vessels fill as the water rises and record the height to which the sewers have been surcharged. The tins are protected from roof drippings by the hood (C).

Concrete Pile Standards

A booklet just published by Hunley Abbott, 11 Pine street, New York, entitled "Concrete Pile Standards," is a book of drawings, specifications and other data prepared for the assistance and convenience of engineers, architects and designers who have to prepare specifications and plans for concrete pile foundations. It touches on practically every step in the design of such foundations and much time and expense may be saved by the use of these standards. The price of the book is 50 cents and it contains:

1. Standard details of reinforced concrete pile caps, full explanation of their design and large scale dimensioned drawings of all the standard and many special cases with estimated quantities and bills of material.

2. Standard specifications for all types

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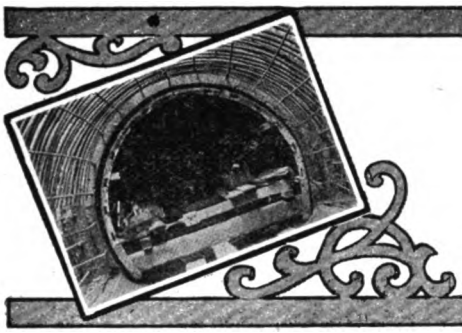

CONCRETE

Testing and Handling of Aggregates for Concrete

From a paper by H. S. Mattimore, First Assistant Engineer, New York State Highway Commission, before the Association of American Portland Cement Manufacturers.

At the invitation of your association I have been directed by the chief engineer of the New York State Highway Commission to discuss the methods of testing concrete aggregates with special regard to those used in concrete pavements. We feel as though we have succeeded in securing a concrete of an excellent quality on our highways principally by the selection of good materials and a first-class quality of engineering inspection.

It is absolutely essential that a good quality of cement should be used in concrete, but we should constantly keep in mind that cement, altho the important ingredient in concrete, is only one of several ingredients used in mixing this product, and in order to secure a first-class concrete the other ingredients must also be of a good quality.

To insure a fine aggregate of high grade our department has drawn up the following definite specifications: "Fine aggregate shall consist of sand, free from organic matter; that which shows a coating of the grains shall not be used until satisfactorily washed." No. 1 sand for use in concrete pavement shall be of the following gradation: 100 per cent. shall pass a ¼-inch screen; not more than 20 per cent. shall pass a No. 50 sieve and not more than 6 per cent shall pass a No. 100 sieve." "Sand may be rejected for this class if it contains more than 5 per cent. of loam and silt." "Mortar in the proportion of one part of cement to three parts of the sand to be tested shall develop a compressive strength at least equal to the strength of a similar mortar of the same age composed of the same cement and standard Ottawa sand."

"Screenings when approved in writing by the chief engineer may be substituted for a portion of No. 1, 2 and 3 sand under the following conditions: The screenings shall be free from dust coating and other dirt, 100 per cent. shall pass a ¼-inch screen and not more than 6 per cent. shall pass a No. 100 sieve." The compressive strength of a mortar in which the screenings and sand are in the proportions intended for use, shall be at least equal to the standard strength obtained with sand of the given class."

You will notice from the specifications quoted above that the only allowable use for stone screenings as fine aggregate is when mixed with a proportion of sand. We have had some field tests made on using all screenings for fine aggregate and these have shown such doubtful results that it was not thought advisable to replace all of the sand by screenings. It is possible to get good concrete with screenings in laboratory test, but when tried on a large scale in the field it is extremely difficult to get a uniform well-graded material. The proper proportion of screenings from the hard variety of stone will improve a fine-grained sand, but the high costs for careful inspection and proper mixing is likely to make their use prohibitive, except in instances where a good quality of sand is very expensive.

The specification for stone as coarse aggregate in concrete requires that samples shall be tested before being used in the work. It must be free from dirt and coating of any kind. As a tentative specification we require that stone for use in concrete pavement shall show a "French coefficient" of at least nine when tested in the standard abrasion test for stone.

Some few miles of concrete pavement have been built with gravel used as coarse aggregate. These were in sections where a very high grade was available. Such material was all tested and had to meet the equirements of being composed of all sound, durable stone, and to be absolutely clean and free from coating. We have found the gravel banks in a large part of the state to run so non-uniform that it was not thought advisable to use this product in concrete pavements except in limited areas where we have assured our-

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selves from past experiences that a uniform product can be obtained.

An endeavor is made to use local materials as far as possible in all our work, and the above specifications were written after a careful study of several hundred sand tests from widely scattered portions of the State. Availability was considered with the idea of quality paramount.

During the routine of the physical laboratory within the past year the work included the examination and testing of samples representing 1,080,580 barrels of cement, 909 samples of sand and 857 samples of stone. The cements were tested according to the standard methods of the American Society for Testing Materials, with which no doubt you are all familiar. There being no standard tests for sands, the following is a brief outline of the tests and methods employed in our laboratory:

Gradation—1,000 grams of the sand to be tested, after a careful weighing, is screened through the ¼-inch, No. 6, No. 20, No. 50, No. 100 and No. 200 mesh sieves. After weighing the residue on these sieves, the proportions passing are readily computed. We found from past experiences that these are the essential sieves for an intelligent judgment of the gradation.

Voids.—For the determination of the voids, the sand is placed and loosely compacted in a graduated cylinder. This latter has a hole drilled in the bottom in which a tube is connected leading from a burette filled with water. This apparatus is placed and worked so that gravity causes the water to rise slowly thru the sand, forcing the air ahead. By reading from the burette the amount of water which has flowed out, the voids can be computed with a practical degree of accuracy. This method of allowing the water to flow in from the bottom rather than from the top of the sand eliminates the forming of air pockets, which are extremely difficult to avoid by the latter method.

Loam.—For the determination of the amount of loam, a portion of the sand sample is placed in a graduated cylinder and well covered with water. This is thoroly agitated and then allowed to settle from ten to twenty-four hours. The loam and silt, which readily separate from the sand, are deposited on top of the sand and the proportion can easily be computed. This method of loam determination by volume, we believe, is as refined a determination as necessary to fit all practical requirements. It also allows an easy method of checking in the field.

Compression Tests.—The majority of our compression tests are made on 3-inch cubes mixed 1 part of cement to 3 parts of the sand. These are stored in moist air and broken in fourteen days; 4 cubes are made from each sand, 2 from the natural product and 2 from the washed. For a comparison of the compression, 4 cubes of the same size mixed with standard Ottawa sand and the same cement are made, stored and broken under the same condition and at the same age. The cement used for this purpose is a blend mixed in the laboratory from cements which show similar characteristics under tests. The cement and sand in the cubes are proportioned by volume rather than weight to avoid the variation of the latter in sands of different character. The cement, altho measured by volume, is carefully checked by weight to eliminate different degrees of compactness in measuring.

At present time we are running a series of sand compressions on both two and three-inch cubes for the ultimate purpose of using the smaller size cube. These latter will be made up in lots of four, two of which will be broken at seven days and two at twenty-eight days. This in many cases will decrease the time necessary for a sand test and also enable us to observe the relations of the strengths at the different ages.

Of our tests we consider the compression strength of the sand in mortar of major importance, but as this depends more or less on other determinations, especially gradation and percent of loam, silt or organic matter, it is advisable to run a full test in order to properly judge the material.

Occasionally sands are tested for tensile strength, but our experience on the relation between tension and compression strengths of sand mortars has verified the results obtained by other investigators in the fact that this relationship is so non-uniform that it is absolutely unreliable, and as we build plain concrete to withstand compression rather than tension, we should test it from that standpoint.

During the course of construction, the concrete highways are under constant supervision of competent engineers, their duties not only include ordinary highway way engineering work, but they are required to closely inspect all concrete aggregates. This especially refers to sand and gravel supplies, and when such material shows any great change in character, this being determined by field tests for gradation and loam, such conditions are immediately reported to their superior engineer, who takes steps to rectify them and compel the contractor to secure suitable materials.

One of the important checks instituted within the past year on our concrete work was in the testing of the finished product. Engineers in charge of concrete work are required to make 6-inch cubes from the

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mixed concrete as deposited in the work. Two cubes are taken from every 500 cubic yards of concrete laid. This, in the case of a concrete highway sixteen feet wide and of our standard thickness represents about 1,700 linear feet of roadway. These specimens are stored in moist sand near the highway for twenty-one days, at which time they are sent to the laboratory, where at twenty-eight days they are tested for compressive strength. The engineers on the highways are notified of the results of such tests and this seems to have promoted a friendly rivalry between them to endeavor to obtain the best possible concrete. This pride in accomplishment certainly tends toward obtaining desired results. The chiefs of the department do all in their power to build an excellent type of highway, but in the end much depends on the engineers directly in charge.

By means of the above described tests I know we obtain a good quality of aggregates and the final tests on the field cubes give us an excellent check on both material and workmanship, but we also realize that the using of concrete for highway surfacing introduces the factor of making a concrete to resist impact and abrasion. This at present is well taken care of by using a rich mixture, but at the same time we are studying both concrete and mortars from this standpoint and hope in the near future to be able to devise some method of testing the abrasive and impact resistance of various aggregates.

The curves in the accompanying diagram are self-explanatory. Their main value is that they are the results of field tests, thus giving a good illustration of the concrete obtained in actual practice. I believe this is a good fair comparison of stone and gravel concrete, as both of these aggregates were of high grade, particular attention being paid to obtain a clean, uniform product passing all requirements for this class of concrete.

You will notice the material made with screenings, altho showing a fair compression strength, is much below that obtained with a good sand. These latter cubes were made from concrete placed on highways previous to the adoption of the specifications quoted above.

Expansion Joint for Concrete Paving

The accompanying photograph shows the method of placing the Trus-Con armor plates for protecting joints in concrete paving. The form of the plate, with the double hooks for tying the plate back into the concrete, can be seen clearly. The picture was taken on McKinley Place, Grosse Pointe, Mich., opposite the Country Club, running thru a district of expensive suburban homes.

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Development in Culvert Construction

By Edward J. Whalen, Syracuse, N. Y.

One of the essential features of a modern road is the proper drainage. Usually ditches run along the sides or on one side of a road, and at certain points in order to keep the water level down, the water is carried from one side of the road to the other. These ditches should be of good size, and be able to take care of all ordinary rainstorms. They should be free from obstructions so as not to block up the ditch, causing the water to rise too high. If the water stands in the ditch it soaks into the base of the road. The result is a big mudhole in the road, the top settles down, and the people who use the road are not very much in favor of riding over it in an automobile. Sometimes, you will find water going over the road, caused by a culvert being too small.

What is a culvert? It is a covered channel, to carry water from one side of the road to the other.

Years ago, culverts were made from wood, as that was the handiest material at that time. However, it is not used much any more. It was very expensive, and dangerous, as it decayed quickly, and many lawsuits were brought against townships on account of horses, cattle, etc., being injured, or legs broken by stepping into holes. Traction engines usually dropped through every one they came to. It is very seldom that a wooden culvert is found nowadays. They are and should be a thing of the past.

As time went on, manufacturers brought forward the drain tile to be used in place of a culvert. They were taken hold of readily, and came into general use in many localities, and were of great benefit to their manufacturers. In fact, I know of a culvert made of drain tile which was replaced one a year for several years. However, the drain tile has the disadvantage of causing high water levels, and insufficient capacity, owing to their being round. The frosts and other causes lead to their disintegration, and as a result of heavy traffic they soon break down.

Later on, commercially minded people began bringing out pipe, sheet iron tubes, etc., for culvert use.

States which have modern, efficient, highway organizations, have prohibited their use, and the use of inefficient, poor quality pipes is not encouraged anywhere. They lack sufficient capacity on account of their being round, and cause high water levels. Sometime these pipes are galvanized and are used in primitive road building today. That is, where they are experimenting, not profiting by the mistakes of others. They are hardly ever provided with head walls, which are very essential. A culvert without a head wall is like a tack without a head. You can put it in, but it is not much good. Such a substitute for a culvert seldom if ever, was as long as the width of the road. The water wore away the sides of the road, and if you drove along the road it was necessary to keep in the middle of the road or get wrecked. In a few months time the small pipes became clogged and filled up, and perhaps their location was lost.

Now, as we understand it, the primary object in putting in a culvert is to carry the water from one side of the road to the other, a culvert being an artificial archway under the road. The first idea should be to have a permanent and a durable culvert, with ample capacity, and the culvert should be wide enough to take care of flood conditions, and at normal times to furnish a good pasasge for the water. Especially in the spring, as the surface of the earth road at this time is soft, is easiyl washed away, and should not be forced to flow across the road. We might say, that the road surface should be rounded also.

It would be a better and more economical procedure to build where the head room is limited a concrete culvert which could be a semi-circular nature, with a radius of 12 inches, for example. This would have the same head room as a 12-inch pipe but would have twice the capacity. It is very strange that anyone who uses his head would use a small round pipe in this instance if he wanted to lower the water level and increase the capacity. He simply works against his better judgment. Here again, a great mistake is made, they sometimes use a larger pipe, and raise the surface of the road, resulting in a hump in the road which is rather unpleasant to drive over, unsightly and unnecessary. In some places they call them "thank-youmams," but no one is thankful that they are there.

All this experimental work is absolutely unnecessary. Semi-arch, standard, permanent, beautiful, monolithic concrete culverts are easily, quickly, and readily constructed by using a collapsible steel culvert form, with equipment for building head walls, wing walls, etc., and requires no more head room than the little round pipe. Such a concrete culvert is based on the universal law of efficiency and economy, and has a 300 per cent. lower water level.

New York state has certain standards for her culvert construction, and all these standards have to be adhered to, altho they have flat tops. Still every one knows that an arch gives greater strength, and uses less material, and

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gives greater capacity. However, New York state standard structures were designed by the world's greatest engineers. Some of New York state standards are as follows: 24x15 inches, 27x24 inches, 30x24 inches, 54x24 inches, etc. The tendency si to have the culvert long span and low rise. Any of these standards are easily built by a modern, standard, collapsible steel form.

Standardization has been adopted in some states, and should be in all. However, they are only in evidence in states which have diligent highway departments. This custom of letting every highway official do as he wants to results in peculiar developments, which show the lack of engineering judgment.

Concrete in culvert construction is superseding all other materials, the same as it did in sidewalk, curb, gutter, bridge, and road work. It is permanent, and saves huge sums of money every year.

The concrete mixer has been a great help in the work. There are a good many mixers on the market, in all sizes and conditions, and their prices are reasonable. They are labor savers and hence, moneymakers.

However, the mixing of concrete does not end it all. One should have the right kind of a mold or form to pour the concrete into. One that is easily and quickly set up, and can be readily removed. One that is durable, rustproof, and watertight, and can be used for a number of different styles. The remedy is a good, collapsible, steel, culvert form.

Lumber is too expensive. It requires the services of an expert carpenter to build a wooden form, moreover a wooden form cannot be used more than three times, before it is all warped out of shape, and has to be thrown away, as the concrete is wet, and the air is dry, and the result is the form is soon wracked to pieces. Another great trouble is that the cement in solution passes out through the cracks of the wooden form, and the culvert is filled with cracks, resulting in an impoverished culvert, with a short life. Disintegration takes place. Some people blame the concrete or cement, however, it is the fault of the one who permitted the use of the wooden form.

Build your culverts from Boston to San Francisco of concrete over a standardized steel culvert form, and instead of ill-looking culverts, you will have beautiful, standard, monolithic, permanent concrete culverts, which will be monuments to their erectors for all time.

The sizes of culverts should be the same for the same conditions everywhere, and should be as standard as the wagon gage, railroad gage, etc.

Universal Safety Standards

The first volume of the Universal Safety Standards, "Machine Shop and Foundry," by Carl M. Hansen, M. E., chief engineer of the Workmen's Compensation Service Bureau, New York City, M. Am. Soc. M. E., is a handbook of concrete examples of safeguarding and rules for practice in machine shops and foundries.

This is the first one of a series of books which will be issued under the direction of the Workmen's Compensation Service Bureau, in the course of the next two or three years. The titles of the others will be Woodworking, Leather and Shoe, Mercantile and Theaters, Textile and Clothing, Brick Pottery and Glass, Paper, Printing and Allied trades, Electrical, Grain and Flour Milling, Dyeing and Laundry, Mining, Miscellaneous. These books will all be compiled under the direction and with the approval of the Workmen's Compensation Service Bureau. They will all bear the endorsement of the leading compensation and liability insurance companies and these standards will be exclusively used in fixing the rates for workmen's compensation insurance under the Universal Analytic Schedule.

Compensation on laws have made indemnity for accidents compulsory. This indemnity is one of the large items in the cost of production. To reduce the cost of production and effect a saving in operation, accident prevention is one of the most prolific fields. Employers and others interested in safety need authoritative information on the methods of assuring safety which will meet the requirements of the rulings of their insurance companies.

In order to supply this demand, safety must be standardized. The Workmen's Compensation Bureau has seen fit to adopt Universal Safety Standards as its minimum requirements for industrial safety. It makes this approval because the book "Machine Shop and Foundry" (Universal Safety Standards) represents, in its opinion, the ideal condition for which they are constantly striving. These standards were prepared with the aid of some eighty engineers working under Mr. Carl M. Hansen's direction and with the advice of and contributions from the leading industrial organizations in the country.

The book is purely a "How" book on safety as opposed to the usual type of "Why" book. It starts where others stop; viz., where others convince you that safety is necessary, this book shows what is necessary for safety. It describes and specifies conditions and machines and safe means and measures for guarding these conditions and machines.

But it does not stop there. With each

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specification it shows a detailed drawing of what the specification means, all of which is the application of the principle of safeguarding. This arrangement makes everything absolutely clear even to the machine operator. Very interesting examples are the treatment of stairways, steam engine guarding and grinding wheel protection.

This system is now being applied in thirteen states and last year twenty thousand plants were merit-rated, having one million two hundred thousand employes and with a payroll of seven hundred million dollars. This produced a saving in premiums in the neighborhood of two million dollars. The cost of installing safety devices in general is made up in the savings on insurance premiums. As part of this system, it has become necessary to standardize safety as a basis for rate deduction, and this volume, "Machine Shop and Foundry" is the result. It is the first time that a comprehensive study of this kind has ever been made.

The volume is attractively bound in limp seal leather, 312 pages, indexed, price, $3.00 net, and is issued by the Universal Safety Standards Publishing Company, 12th and Race Sts., Philadelphia, Pa.

By-Product Coke Oven Gas for Chattanooga

The Chattanooga Gas Co., Chattanooga, Tenn., is making elaborate prepartions to push the sale of gas for manufacturing purposes, incident to their contract with the Chattanooga Gas & Coal Products Co. to buy 200,000 feet of gas daily. The latter concern is now erecting a 12-oven plant, each oven of 16 tons capacity, of the Roberts type. The plant, it is anticipated, will be finished and in operation next spring. When completed, the investment will be between $450,000 and $500,000. The plant is a by-product one, the company itself planning to develop, aside from gas for furnace, foundry and domestic use, coke, tar and sulphate of ammonia. Further than that the coal products company will not go, but is anticipated that other industries will be attracted by the supply of by-products, such as tar, and establish plants for the distillation and conversion of same into commercial forms. Also, there is good reason to believe that the gas, sold at rates fairly competitive with natural gas, will attract manufacturing lines such as pottery and glass, the former not now represented in the Chattanooga district at all, the latter by only one factory.

The by-product plant is located in one of the suburbs of Chattanooga. The company is subsidiary to the Durham Coal and Coke Co., of that city, and will coke coal from the immense coal lands of that company. It will be necessary to lay some four miles of gas mains to pipe the gas from the by-product ovens to the distributing system of the Chattanooga Gas Co. The first order for pipe aggregated 22,000 feet, or an expenditure, it is stated, of about $20,000. The order was placed with the James Supply Co., of Chattanooga.

The distributing company plans an extensive campaign for inducing manufacturers to adopt the use of gas for mechanical purposes instead of coal. To interview manufacturers of various gas machine appliances, General Manager S. E. DeFrese, who is president of the Southern Gas Association, visited Chicago recently in connection with his trip to the National Commercial Gas Association meeting in Minneapolis. On his return, he began the remodelling of the downtown office and exhibit rooms in order to install an exhibit of gas appliances for the special purpose of demonstrating the various uses to which gas can be put in the mechanical arts.

Introduction of by-product ovens at Chattanooga creates a very interesting situation and one which will doubtless be watched keenly by those connected with the gas industry and lines of manufacturing in which gas is used. It should help very patently in the industrial growth of Chattanooga, which is already an important manufacturing center with nearly 300 factories and greater diversity of products (1,137 articles) than any other southern city. The Chattanooga district is one of the principal soft coal producing sections of the country, 20,000 tons being mined daily. The Roberts oven, furnished for the plant at Chattanooga by the American Coal and By-Product Coke Co., Chicago, is the only flueless type on the market. It is claimed to coke coal in a shorter time than other types and also to produce coke suitable for metallurgical purposes from coals which have heretofore been technically known as non-coking.

The Western Gas Construction Co., Fort Wayne, Ind., is furnishing the by-product equipment, which is standard, and of the so-called indirect process for ammonia recovery. Kerr-Murray Co., Chicago, were awarded contract for gas holder; Wallman, Seaver, Morgan & Co., for coke pushing and coal levelling machinery, and lorry cars; R. H. Beaumont & Co., Philadelphia, for coal and coke conveying, screening and grinding machinery; American Refractories Co., Chicago, silica brick. Several Chattanooga firms also participants, such as the Casey Hedges Co. and Converse Bridge Co.

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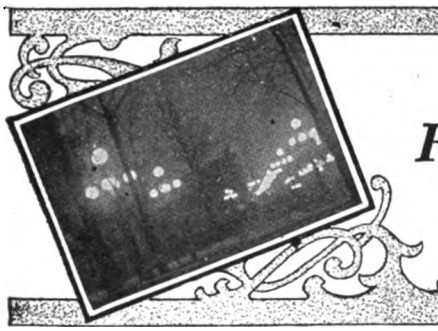

FIRE AND WATER

Locating and Mapping Pipes and Valves in an Old Water Works System

By Carleton E. Davis, Chief of Bureau of Water, Philadelphia, Pa., before Section D, American Association for the Advancement of Science.

FOR the adequate control and effective operation of the distribution system of a municipal water works, the location of pipes and valves should be definitely known, as well as the function performed by such pipes and valves. Data should be recorded in such a way as to be readily understood and interpreted and should be accessible for immediate use, in case of an emergency, by more than one person. The more complex the system, the more important becomes definite and easily used recorded information stored only in the minds of certain individuals.

For one reason or another, too much dependence has been placed upon the personal knowledge of individuals, or, perhaps, a single employe, and too little has been done upon the work of recording facts and data in such shape as to be of use by any person, incidentally extending thereby the usefulness of many persons.

The lack of proper records and plans may be felt in a minor degree as an everyday handicap, but is liable to be particularly emphasized in case of an accident, such as a break in a main pipe. Here the flow of water must be stopped, and the circulation readjusted so as to cause as little annoyance and incvonvenience to consumers as possible. This means that a number of valves must be first found, and then operated in such a manner as to produce the desired results, and such work must be done quickly.

Of scarcely secondary importance is the necessity of similar records for service pipe connections from the mains in the streets to the properties of the consumers. Affiliated with these latter records are the data recording the arrangement of water piping inside buildings or private properties, with special reference to unauthorized outlets or connections with a private, and possibly contaminated, water supply for fire or manufacturing purposes.

The situation in Philadelphia may be typical. It is not intended in this paper to give the details of the locating and mapping work that is being done in this city, but to outline briefly the general principles controlling such work.

The original water works of Philadelphia were constructed about 1801. The first cast-iron pipe was laid in 1817, and considerable pipe which was in the ground as early as 1820 or 1830 is still doing service in the distribution system. The present city is an amalgamation of a number of distinct municipalities, some of which had water supplies at the time of incorporation with the larger community. Such water works were joined to the Philadelphia supply and are even now a part of the general system.

As the city of Philadelphia has grown, various water supply projects have been developed, used, outgrown and abandoned in whole or in part. During the last fifteen years the introduction of a filtered water supply has brought about a radical readjustment of the principal supply mains and a realignment of the distribution districts.

Certain general maps and plans are available, invaluable as a basis of a more comprehensive and useful record scheme, and representing a large amount of research in the past, hard work and wise foresight. These particular maps in Philadelphia were compiled by Mr. William Whitby, of the Bureau of Water. They are now being developed and expanded with a view of increasing the amount of detailed information, distributing such information widely thruout the Water Bureau, and putting it in such shape that a larger number of employes can be used to a greater advantage by reason of its existence and accessibility.

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The scheme provides certain general features:

1. Data used chiefly for controlling and regulating the amount and pressure of water thruout the system, or in other words, data used in operating the supply.

Under this head are maps defining the limits of the several distinct distribution areas, which maps are accompanied by data showing the sources of supply for each area and a list of valves controlling the supply; likewise general maps showing all large mains, reservoirs and pumping stations, together with detail maps of the piping system and operating valves at the pumping stations, filters and reservoirs.

2. Data used chiefly for repairs and maintenance.

Under this head are maps showing the complete gridiron of distribution pipes on which the locations of all valves and hydrants are indicated. The detail of such maps is expanded by intersection plans showing on a larger scale the situation at each street intersection. Each street intersection is mapped on a separate plan of a size convenient for use in the field.

3. Data used chiefly for the business relations between the consumer and the Bureau of Water.

Under this heading come data relating to service pipe connections, such as the location, depth, size, date of insertion, kind of pipe, etc. These data are listed in a card index and filed by streets and numbers.

The system likewise proposes under this head full plans of all pipes in important establishments which may have a special supply for sprinkler systems or other fire protection. These plans will indicate the relations between pipes carrying city water and private pipes which may carry a possible polluted water from a private source, introduced for the purpose of fire protection or manufacturing. The necessity for the complete severance of these dual supplies can be readily seen.

¶ THE PROGRAM *for locating and mapping existing pipes is laid out, with suggestions of methods for use in special cases.*

Assuming an available force of sufficient size and individual experience and capacity, the work of mapping pipes and valves proceeds normally along three lines:

1. Compilation of existing data wherever and however those data may be listed:

Reports and plans were searched and examined, though of course the chief mine of information was found to be in the memory of old employes. Considerable tact and discriminating judgment were necessary to elicit the information stored in the minds of these old employes and give to such information its true value and assign to it its proper place.

2. An investigation and determination of the present and possible function and use of the several parts of the system.

In investigating the use and possibilities of the present pipes, pitometer corps, equipped with apparatus to measure readily the flow in any pipe, have been used to great advantage.

These pitometer corps serve a twofold ourpose, for, while measuring and studying the flow of water and determining its fluctuation, they at the same time detect leaks and locate points of undue use or waste. Incidental to this study of the flow is the operation of control valves, in the course of which the location of the valves is verified, their condition and character are noted, and other data obtained which form part of the detail location maps.

More or less information is likewise brought to light concerning service pipes, even some unknown ones being unearthed. Various devices are on the market which aid in locating lost service pipes, tho sometimes nothing but digging will bring the desired information.

Governing the rather restricted operations of the pitometer corps is an overhead study of the whole distribution field, including investigation of proposed changes in the major control system.

Like the pitometer corps, which obtains certain incidental facts while working along definite lines for the purpose of obtaining other information, the general repair and maintenance forces are likewise utilized for the same purpose. Without adding noticeably to their labor, they turn in much that is valuable in the shape of permanent records. Each foreman in charge of a repair or maintenance crew is furnished with a pad of paper showing the lines of typical street intersection with house lines, curb lines, etc., printed on it. Whenever and wherever such a crew is called for work, the foreman is required in his spare minutes, which always occur in such an operation, to list up on these blanks such data as an intelligent inspection of his immediate vicinity will discover. He likewise is required to operate such valves as can be conveniently handled and turn in a record of such operation. These field records are sent in to a central office and are used in verifying permanent records or for making new records on the detailed per diem maps.

3. The proper recording of new work and the reduction to tangible shape of existing data.

February, 1915.

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The system in vogue in Philadelphia depends upon the centralized overhead control. All new work is directed from a central office, thereby insuring uniform practice and procedure, stimulating branch offices by the feeling that their returns are scrutinized and compared with similar returns from other branch offices. As the attempt is made to secure results from what would otherwise be lost time, or, in other words, a utilized by-product, this introduction of competition is valuable. Uniform practice and procedure are essential, as a man transferred from one section of the city to another feels at home among the familiar records, even tho the geography of the district is strange.

Book records have been discarded as far as possible in favor of records capable of easy and rapid reproduction. A complete and satisfactory record, distributed as widely as desired, may not be obtained for some time to come, but enough has already been accomplished to prove the worth of the system.

Combination Street Sweeper and Sprinkler

The accompanying photograph shows a combination street sweeper and sprinkler which has several points of advantage. The machine does the work of both sprinkler and sweeper in a very satisfactory manner.

The sweeper is the regular Acme sweeper of the Studebaker Corporation of South Bend, Ind., nearly all of which is clearly seen in the photograph. The steel frame and the wheels show for themselves. The equalizing lever for raising and lowering the broom is seen by the side of the driver's seat. The iron shield in front of the broom, the apron seen outside the large rear wheel at the left of the picture and proper sprinkling ahead of the machine keep the dust down to a minimum.

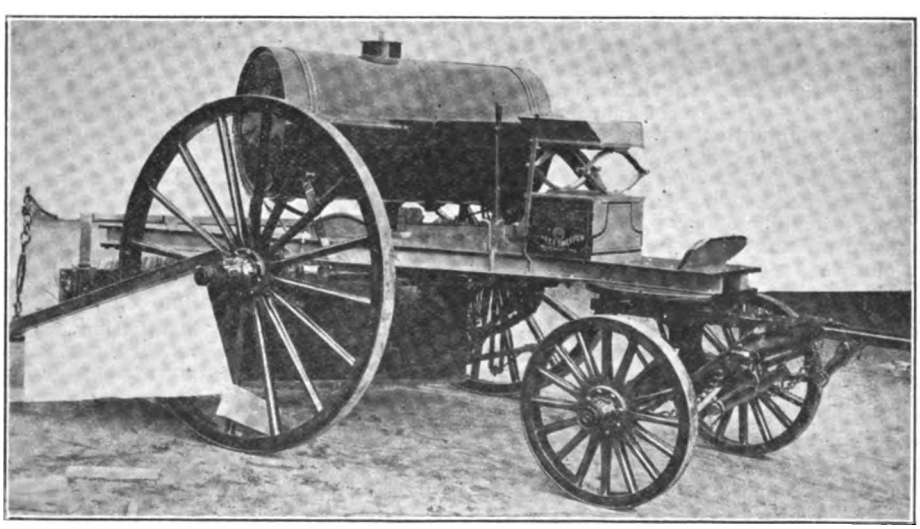
The sprinkling attachment consists of a 175-gallon galvanized steel tank, mounted on top of the frame behind the driver's seat, as shown. Water from this tank is discharged thru its bottom by means of a perforated pipe seen in the picture, running parallel with and just in front of the broom. The lever nearest the driver's seat opens and closes the valves controlling the discharge of the water, which are so constructed that more or less may be delivered, according to the needs for dust-laying purposes.

A few of the cities using this combination machine are Salem, W. Va., West Newton, Pa., Moultrie, Ga., Winston-Salem, N. C., Jacksonville, Fla., El Paso, Tex., Portage, Wis., Krugman, Peru, and Van Buren, Ind.

Automobile Fire Apparatus for Grand Rapids, Mich.

At a recent meeting of the Board of Police and Fire Commissioners of Grand Rapids, Mich., it was decided to place an engine in Station 12 and to put an additional automobile fuel wagon in service.

All the ladder companies in the city now have automobile apparatus. The chief officers have been provided recently with automobiles, also two of the larger engines with tractors, and five more automobile hose wagons and two chemicals have been provided.



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Cost of Maintaining Automobile Fire Apparatus

From the report of the department of fire and police of Chattanooga, Tenn., for the year ending September 30, 1014, the following figures are taken as to work done by automobile fire apparatus and cost of maintaining them:

	Chemical.	Engine.	Chief's Car
Alarms answered	320	147	.....
Miles traveled—			
At work	1,122.6	409.9	.....
Exercising ...	266.4	524.7	.....
Chemicals used, gallons	5,097	.....	.....
Feet hose laid at fires	16,500	13,350	.....
Feet ladder used	1,107	.....	.....
Time pumped—			
At fires	....	12 hr 35 m.	....
Practice	....	3 hr. 15 m.	....
Supplies and repairs cost	$311.22	$218.22	$381.47
New equipment cost	.....	25.01	.....

Improvements in Fire Protection for Philadelphia

Of the funds available from Philadelphia's $11,300,000 loan bill of November 19, 1914, only $100,000 was apportioned to the fire department for the purchase of new apparatus. With this it is planned to motorize five outlying engine companies, one other engine now having a motor hose wagon, and two centrally located trucks, and to purchase five new automobile ladder trucks and two automobile combination hose wagons. It is possible also that provisions may be made for the purchase of four more automobile combination wagons and one automobile pumping engine, for establishing one new engine company and three additional hose companies.

Approximately 50 per cent. of the engines at present in service are old and of an obsolete type, and it is difficult to keep them in condition to deliver even as much as half their rated capacity. Extensive repairs on these engines are not justified, and provision should be made each year for the replacement of a certain number of the poorest ones.

The fire-boat, altho recently repaired, is old and of very unsatisfactory type.

As to the water supply, provision has been made for a 48 and 36-inch belt line supply main for South Philadelphia, a 48 and 36-inch supply main across the central portion of West Philadelphia, preliminary filtration and sedimentation basins at the Torresdale plant and the expenditure of about $100,000 for reinforcement of the general system of distribution.

The average annual per capita expense of maintaining the Philadelphia Fire Department has for years approximated 53 per cent. of that borne by the eleven other largest cities of the United States.

Improvements are recommended by the Fire Underwriters as follows:

1. Establish ladder companies with Engine Company 20 in a new station near the present location; at Broad street and Montgomery avenue; with engine companies 40, 41, and 55 or 42.

Additional companies are at present needed at or near Washington avenue and 3d street and Spring Garden street and Ridge avenue, but with the two nearest ladder trucks to each of these locations motorized, these two new companies would no longer be required.

2. Purchase a new water tower and place in service with Ladder Company 2.

3. Establish an engine company in the vicinity of Chester avenue and 54th street.

Unless the three nearest engine companies are motorized in the near future, additional engine companies are also needed in the vicinity of Kensington and Tioga streets and of Media and 54th streets.

4. Establish regular and systematic tests of all engines and of the hose that has been in service over 3 years. Recent tests resulted in purchasing about $15,000 worth of hose with more to follow.

5. Replace during each of the next three years at least ten of the old fire engines.

6. Provide a more rapid extension of the underground system where ducts are available, particularly in all closely built sections, using No. 14 rubber insulated copper wire with extra heavy lead sheathing.

7. Increase the number of box circuits so that not more than twenty boxes shall be connected to any one circuit.

8. Provide for a reduction of the excessively high rates of consumption by the more rapid installation of meters.

9. Provide for the installation of the 60-inch supply main from Lardner's Point station to the distribution system.

10. Provide all possible means for carrying out the general plan of the department, whereby the pressures in the congested value districts will ultimately be raised to approximately 90 pounds.

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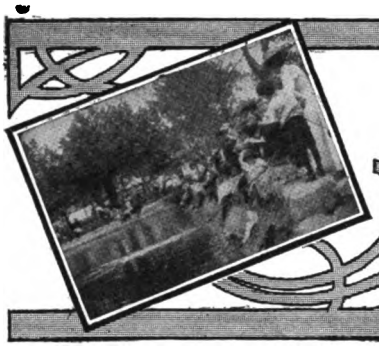

Municipal Problems

Charter Changes for Los Angeles

On the last day of 1914 the citizens of Los Angeles, Cal., vote on the following proposed changes in their city charter, the cities of California having a large measure of home rule:

1. City manager; abolition of boards and commissions; appointment of department directors; eight councilmen, with mayor president of council.
2. Establishment of boro system for annexed territory to create market for surplus aqueduct water.
3. Authority of the city to issue investment, district and revolving fund bonds to handle the district bonds voted by the newly-formed irrigation district in San Fernando valley and others.
4. Elevation of tracks to parallel streets as well as to cross.
5. Appointment of members of school board by mayor and council.
6. Street railway subway under Silver Lake park and others.
7. Consolidation of city and county tax offices, letting county do the work now done by both city and county tax assessment and collection service.
8. Minority representation, allowing groups of voters to have proportional representation on council.
9. Donations for public parks to be handled by special commissions, thus doing away with such controversies as that between Griffith J. Griffith and the park commission.
10. Authorizing harbor commission to make emergency purchaser.

Municipal Police Departments — Their Relative Size.

Compiled by Andrew Linn Bostwick, Municipal Reference Librarian, St. Louis Public Library.

These tables attempt to compare the police forces of the largest cities as to size only. They do not purport to draw any conclusions as to the efficiency of the departments, or any other similar question. It should be borne in mind that tables of this sort are useful only in giving a general idea of the subject. To make a more exact comparison of the sizes of police forces it would be necessary to conduct a most exhaustive study and consider a great many factors that have not been reckoned with here.

The information in the tables is practically all up-to-date. The statistics as to street mileage and number of patrolmen are taken from letters received from official sources in December, 1914. The population figures are those given by the Census Bureau as estimates for 1914; the figures as to area of cities are taken from the World Almanac, which, in turn, received the information direct from the municipalities.

Columns I to IV of the tables are self-explanatory.

Column V shows the total number of patrolmen on the police forces, whether assigned to beats or not.

Column VI shows the average number of patrolmen working at a given time, on beat duty or otherwise. Each city has its own way of dividing its force into two or three platoons, and the systems vary so greatly that in making a general comparison the simplest procedure is to divide the total number of patrolmen by the number of platoons, and compare the results thus obtained.

Columns VII and VIII are self-explanatory.

Column IX furnishes a good basis of comparison—the number of patrolmen on duty per unit of population. (See note to Column VI, above, for explanation of term "on duty.")

Column X is self-explanatory.

Column XI shows another good basis for comparison—the number of patrolmen on duty per unit of city's area.

Column XIII expresses in another form the comparison shown in Column IX.

Column XIII furnishes another basis of comparison—the number of miles of street per patrolman.

Column XIV shows the number of miles of improved streets per patrolman. This again furnishes a good means of compar-

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ison. The sections of a city that are built up to any degree, and sufficiently populated to need any amount of police service, are generally those sections that are served by improved highways. Unimproved streets in many cases are mere "paper" streets, in areas not populated at all. For these reasons Column XIV should be considered.

City.	Area in sq. mi.	Population U. S. estim. 1914.	Miles of streets.	Miles of improved streets.	No. of patrolmen.	No. of same on duty (average).	No. of platoons.
	I.	II.	III.	IV.	V.	VI.	VII.
New York	326.8	5,333,537	3,390.00	2,055.00	9,258	3,086	3
Chicago	191.3	2,393,325	2,991.41	1,759.87	3,407	1,136	3
Philadelphia	129.5	1,657,810	1,587.21	1,374.01	3,190	1,063	3
St. Louis	61.3	734,667	932.62	642.39	1,400	467	3
Boston	47.3	733,802	568.03	528.05	1,400	467	3
Cleveland	51.8	639,431	852.00	530.00	680	340	2
Baltimore	31.5	579,590	555.00	515.00	790	263	3
Pittsburgh	41.0	564,878	1,060.00	540.00	699	233	3
Detroit	41.8	537,650	700.00	462.50	908	303	3
San Francisco	46.0	448,502	824.00	414.00	766	255	3
Milwaukee	25.6	417,054	600.00	392.00	500	167	3
Cincinnati	70.0	402,175	971.50	611.50	520	173	3
New Orleans	196.0	361,221	525.00	294.85	245	123	2

City.	No. of patrolmen per 10,000 population.	No. patrolmen on duty per 10,000 population.	No. patrolmen per sq. mile of city's area.	No. patrolmen on duty per sq. mile of city's area.	Population per patrolman on duty.	Miles of streets per patrolman on duty.	Miles of improved streets per patrolman on duty.
	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.
New York	17	5.7	28	9.3	1,728	1.1	0.67
Chicago	14	4.7	17	5.7	2,107	2.6	1.5
Philadelphia	19	6.3	25	8.3	1,560	1.5	1.3
St. Louis	19	6.3	23	7.7	1,573	2.0	1.4
Boston	19	6.3	30	10.0	1,571	1.2	1.1
Cleveland	11	5.6	13	6.5	1,881	2.5	1.6
Baltimore	14	4.7	25	8.3	2,204	2.1	1.9
Pittsburgh	12	4.0	17	5.7	2,424	4.5	2.3
Detroit	17	5.7	21	7.0	1,774	2.3	1.5
San Francisco	17	5.7	17	5.7	1,692	3.1	1.6
Milwaukee	12	4.0	20	6.7	2,497	3.6	2.3
Cincinnati	13	4.3	7	2.3	2,325	5.7	3.5
New Orleans	7	3.5	1	0.5	2,937	4.3	2.4
Average, 13 cities	15	5.1	19	6.4	2,021	2.8	1.8

Municipal Government in Germany

One of the most valuable practical treatises on municipal government which has appeared is William Harbutt Dawson's "Municipal Life and Government in Germany." The author is an Englishman and his book is a comparison of German and English methods of municipal government and of supervision of municipal activities by the central state authorities.

The methods on the whole are so different in the two countries and the results are so correspondingly different that by the time the full comparisons are made we have considered municipal government from almost every possible viewpoint and have some knowledge of the practical results of almost every method which has been applied.

German cities have a long tradition of self-government which is still almost

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wholly in practice, notwithstanding the development in later years of the theory and practice of an exceedingly strong central state government. Strange as it may seem, therefore, in an empire in which the central idea is the supremacy of the state, the individual existing for the purposes of the state, rather than the state existing for the benefit of the individuals composing it, we have in practical operation the nearest approach to home-rule in the management of city local affairs which is in existence anywhere.

The various parts of the German Empire have developed according to different systems, and the laws governing cities conform to a large extent with the courses of these developments, so that methods and details are by no means uniform in the cities and towns of the empire. This is particularly true of the details of distribution of administration powers, application of the elective franchise and control of finances.

Ownership and control of land by municipalities, planning of towns and housing policies are under much more direct control of the municipal government than in this country.

Public health and police matters are administered by the local authorities, but are much more directly under the supervision of the central government of the state than are the other municipal activities.

The author shows in detail the various methods in vogue for operating or controlling municipal public service utilities and the extension of such control and ownership beyond the lines usually followed in this contry. Relief of the poor, social welfare work, education, theaters and their municipal operation are also explained.

Municipal financing methods, including taxation of local incomes, real estate, trade, consumption and other taxes which we treat under license systems are fully set forth.

The book closes with a general survey and comparison with English municipal conditions and a series of appendices going into special detail in some important lines.

The author is strongly impressed with the efficiency of German municipal administration. It is interesting to note that this efficiency is attained under a system which is mainly the old bi-cameral city council and mayor, with some differences in methods of election which are in this we have largely neglected or refused to apply.

The first of these is the divorce of municipal affairs from party politics. This goes so far that a city cannot memorialize parliament with respect to its relations with the central government, because it is not constitutional for a city to pay any attention to political affairs outside its own interests. Councilmen are selected without party or any formal nominations, and, with a very few exceptions, have not been voted for because they belong to any political party.

Second, the administration officials, from the mayor down, are selected on a merit system, seldom so iron-clad as our civil service systems under political nominations are likely to be, and are chosen without reference to their place of residence. As a consequence, there is a profession of municipal administration, just as there is a profession of teaching in this country, and men are promoted from one desk to another, from one department to another, from one city to another, as they demonstrate their fitness to fill the vacancies which occur.

Employment being during good behavior and the lines of promotion being so many and various, really capable city officials are kept up to the height of their efficiency at all times, and those who demonstrate their inefficiency can be dropped without arousing the opposition of a party machine which may shake the whole structure even up to the President.

Third, while the central government apparently has the right, or the strength to assume the right, to interfere in municipal affairs, and has the veto on any elections or appointments, it does not actually interfere in the conduct of municipal affairs by the local officials, and, in any event, it is not possible, as with us, for a group of persons or even a single person with influence in the State Legislature to bring about a change in the form of city government or the term of office or compensation of city officials in cities of a certain class in order to attain his own ends in his own city or to get even with city officials who have not fulfilled his desires.

While some of the changes in form of government in this country have been effective, at least for a while, none of them are effective everywhere and all the time. All three of the principles so prominent in German administration have been advocated in this country, but when tried it has only been half heartedly or one at

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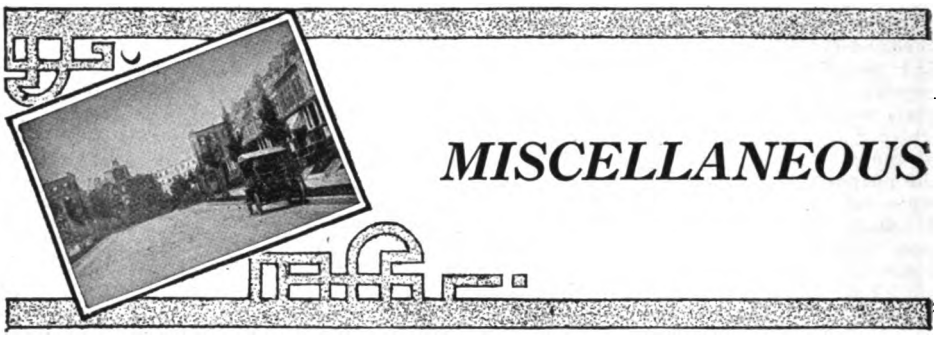

The X Book

One of the most convenient books for the desk of the busy man for his daily use is one called the "X" Book, because it supplies the unknown factor in the problem of keeping track of many things which are before so many busy executives.

It divides the business day into 15-minute periods from 7 until 6, and has space in each division for engagements, record of what was done and when, has a space for a list of the ten most important engagements of the day and a calendar column with space for general memoranda. Each day in the year has a double page of space and the leaves are bound so that the book will lie open anywhere. A bookmark serves to fix the location of the day passing, or any other important page.

As an advance record of coming engagements, a tickler to call attention to the matters of the day and a record of what has been done, there seems to be nothing more to be desired.

G. A. Annable, 47 Broad street, New York, is the publisher and will send the book for $2 in cloth or $2.80 in flexible leather, or it will be sent from this office on receipt of the price.

Iowa Convict Labor on Roads Becomes Self-Respecting

The convicts working on the roads in Iowa have a status differing from that of the convicts in the prisons of practically all other states. In Iowa the men working on the roads receive $2.50 per day for their labor, they themselves paying for their keep and clothing and being at liberty to send the balance to their dependent families. They are still under restriction, but their right to wage lifts them out of the slavery status into that of state wards.

The action of many states in placing those prisoners who can be trusted out to work on the roads is a forward movement. On the roads the prisoner can do work which has value great enough to permit the payment of the wage. Iowa has proved the plan practical; West Virginia, New Jersey, and other states are successfully passing thru the experimental stage, while many more states will enact legislation permitting such work during the coming sessions of the legislatures.

Chats, Chert and Slag as Road Materials

In Missouri a considerable amount of road material is obtained from the tailings of the concentrating mills at the zinc mines. This material, which is put on the market as "chats," consists of small angular fragments of chert and limestone. The zinc companies are very glad to get rid of this waste material, which is loaded on the cars by the railroads of the district at a cost of about 6 or 8 cents a ton. It makes more than ordinarily good roads and is widely distributed all thru the Middle West. It sells in most places at prices ranging from 50 cents to $1 a ton, but in the neighborhood of the mines it can be had for about 15 cents a ton. It is used for railroad ballast as well as road making. The annual output, according to the United States Geological Survey, amounts to about 1,300,000 tons.

In Tennessee and Alabama a quantity of chert is used for road metal, and in many States crushed slag from blast furnaces also furnishes a valuable road material. In Alabama, one of the large iron-producing States, over 2,000,000 short tons of furnace slag, the average value of which was about 25 cents a ton, was crushed and put on the roads last year. Crushed slag is also used as railroad ballast and for concrete and roofing material.

Technical Associations.

The third annual meeting of the Chamber of Commerce of the United States is held in Washington February 3, 4 and 5.

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The subjects of the Federal reserve act in relation to trade expansion, the development of the merchant marine of the United States, the Federal trade commission, rural credits, work of the Bureau of Foreign and Domestic Commerce, trade expansion and the European war, trust legislation and related topics are discussed by the recognized experts in these matters. One evening is devoted to an address by President Wilson.

The American Concrete Institute meets February 9 to 12 in connection with the Chicago Cement Show. A full program of papers on concrete roads, curbs, bridges, culverts, wall columns and beams, stands, stadiums and bowls, bins, sewer pipe, concrete surfaces, reinforced concrete in buildings and various large and small structures, plants and forms for handling and placing forms, properties of cement, fireproof construction and architectural expression in concrete has been arranged

The National Civic Federation has issued a "Memorandum of Suggestions" upon main provisions requisite to an adequate compulsory workmen's compensation law.

The National Conference on City Planning, Flavel Shurtleff, secretary, 19 Congress street, Boston, Mass., now has five volumes of proceedings of annual conferences which can be obtained at $1.50 each for the first two and $2 each for the others, plus transportation charges. The organization also has published eight bulletins, for sale at 10 cents each, or $5 a hundred, except one, for which the charge is 30 cents. The 1915 conference will be held in Detroit.

The American Wood Preservers' Association at its Chicago convention, January 19-21, sustained its reputation for valuable papers and discussions, one of which will be found elsewhere in this number. F. J. Angier, B. & O. R. R., Baltimore, Md., is the efficient secretary.

The Minnesota Surveyors and Engineers Society will meet in St. Paul, February 19 and 20. Geo. H. Merrold, City Hall, St. Paul, secretary.

Resolutions demanding a combined meeting of the American Highway Association and the American Road Builders' Association were drawn up and signed by twenty-five of the leading exhibitors at the Chicago Road Show. The resolutions read: "Resolved, that unless the American Highway Association and the American Road Builders' Association agree to combine upon one time and place for the holding of a single annual meeting national road congress, we, the undersigned manufacturers, positively agree to make no exhibits whatever at any national road congress." It is expected by those adopting the resolutions that all the exhibitors will support the measure. A factor which contributed to the success of the convention from the exhibitor's standpoint was that to a great extent the visitors lived in communities interested in hard-surfaced roads.

The meeting of the New England Water Works Association at the Hotel Brunswick, Boston, Mass., February 10, has for its principal feature discussions of the reports of the committees on meter rates and on filter statistics. Willard Kent, secretary, Narragansett Pier, R. I.

Technical Schools.

The University of Michigan, Ann Arbor, Mich., issues a booklet of 20 pp. descriptive of the full courses in highway engineering carried on during the entire year. A short course will be held during the week of February 15.

The Yearbook of the Michigan College of Mines, Houghton, Mich., contains the schedule of courses and full information about the school and its facilities.

Recent lecturers before the Columbia University graduate school of highway engineering were Edward D. Boyer, expert of the Atlas Portland Cement Company, on "The Construction and Maintenance of Cement Concrete Pavements"; William A. Howell, engineer of streets and highways, Newark, N. J., on "Specification for Physical Properties of Paving Bricks and Stone Blocks"; Nelson P. Lewis, chief engineer New York Board of Estimate and Apportionment, on "Planning of Streets and Street Systems"; C. N. Forrest, chief chemist Barber Asphalt Paving Company, Maurer, N. J., on "Production of Bermudez and Trinidad Asphalts."

The short course in Highway Engineering to be held at the University of Illinois January 11-22, was postponed owing to the danger of spreading the foot and mouth disease now epidemic in Illinois.

The Case School of Applied Science, Cleveland, O., followed the prevailing fashion with a short course on highway engineering January 18 to 26.

In University Extension Bulletin No. 8, prepared under the Bureau of Municipal Information of the University of Iowa, Iowa City, is a collection of "Water Statistics of 38 Cities of Iowa with the Meter Rates of 70 Cities," by John H. Dunlap.

The January list of lecturers before the Columbia University graduate school included Walter H. Fulweiler, chief chemist, United Gas Improvement Company, Philadelphia, Pa., on "Manufacture of Water Gas Tar"; Philip P. Sharples, chief chemist, Barret Mfg. Co., New York, on "Chemistry, Manufacture and Testing of Refined Coal Tars and Methods of Trans-

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portation"; W. W. Crosby, chief engineer, Maryland Geological and Economic Survey, and consulting engineer, Baltimore, Md., on "Preliminary Investigations in Highway Engineering, Value and Methods Employed"; William H. Connel, chief of Bureau of Highways and Street Cleaning, Philadelphia, Pa., on "Special Features in Street Cleaning Work, Snow Removal and Annual Municipal Clean-up Week."

Civil Service Examinations.

The United States Civil Service Commission will hold examinations at the usual places as follows:

February 10: Aeronautical mechanical engineer in Signal Corps Aviation School at San Diego, Cal., at $2,400 a year.

February 24-5: Hull draftsman under Chief of Engineers, U. S. War Dept., at $1,800 a year.

March 10: Aid and laboratory apprentice, Bureau of Standards; aid, and computer, Coast and Geodetic Survey; assistant examiner, Patent Office; copyist typographic draftsman, topographic draftsman, junior chemist, statistical clerk, departmental service; junior engineer, Engineer Department at large; superintendent of construction, Supervising Architect's Office; surveyor, Philippine service.

April 14: Civil engineer and draftsman; computer, Nautical Office and Naval Observatory; copyist ship draftsman, Navy Department; mechanical draftsman, and topographic draftsman, Panama Canal service; engineer, Indian service; junior mining engineer, Bureau of Mines; laboratory assistant, Bureau of Standards.

The Illinois State Civil Service Commission holds examinations at 15 places on February 6 for assistant utilities engineer at $90 a month, increasing to $125. Also on March for junior engineer under the State Highway Commission at $75 a month, increasing to $100.

Personal Notes.

Jos. F. Barton is the new mayor of North Yakima, Wash., which has had the commission form of government for three years, this being the second election. He is the superintendent of the department of public safety. Wilbur Crocker, superintendent of finance and accounting, and Harry Coonse, superintendent of streets and public improvements, are re-elected and chosen for their positions by the commission. The election followed a primary in which there were four candidates for nomination for mayor and seven for commisisoners, reduced to two and four respectively for the second election.

The city commissioners of North Yakima, Wash., have appointed for terms of three years Leonard O. Meigs as city attorney, Benjamin F. McCurdy as chief of police, N. A. Gilman as city engineer, E. G. Dawson as fire chief.

E. B. Van de Greyn has opened offices at 725 Chronicle building, Houston, Tex., for practice as a consulting and constructing engineer, devoting himself particularly to municipal and sanitary engineering, including drainage, irrigation and bridges.

F. V. P. Ellsworth, formerly city engineer of Hot Springs, Ark., is now assistant city engineer of San Antonio, Tex., in charge of paving.

Hazen, Whipple & Fuller is the new name of the firm, made by adding W. E. Fuller. Water works, sewerage, sewage disposal and drainage are their lines of practice, and their offices are at 30 East 42d street, New York City.

Charles Henry Davis, South Yarmouth, Mass., and Fred J. Miller, New York, are two engineers recently appointed members of the Simplified Spelling Board.

George W. Lawson, for some years with the Union Oil Company of California, will hereafter represent the Standard Oil Company of New Jersey and their Standard paving asphalt, made from Mexican asphaltic petroleum. He will also have a high-grade California asphalt. M. A. Giff will be associated with him in his new venture. Their offices are at 1451 Railway Exchange, Chicago, Ill.

Frederick C. Noble, M. Am. Soc. C. E., has opened an office at 50 Church street, New York, for consulting practice.

James R. Valk has been appointed western sales manager for the United States Asphalt Refining Company, with offices in the Harris Trust Building, Chicago, Ill.

Publications Received.

Studies on the Silver Votameter are contained in No. 240 of the Scientific Papers of the Bureau of Standards, U. S. Department of Commerce, Washington, D. C.

Report on industrial wastes from the stockyards and Packingtown in Chicago, made to the Board of Trustees of the Sanitary District of Chicago by Geo. M. Wisner, chief engineer; Langdon Pearse, division engineer; Arthur Lederer, chemist; L. C. Whittemore, resident engineer. Paper, 346 pp.

Annual report of the Smithsonian Institution for 1913, Charles D. Walcott, secretary, Washington, D. C. Cloth, 804 pp.

Annual report of the U. S. Secretary of Commerce, Washington, D. C., for 1914. Paper, 214 pp.

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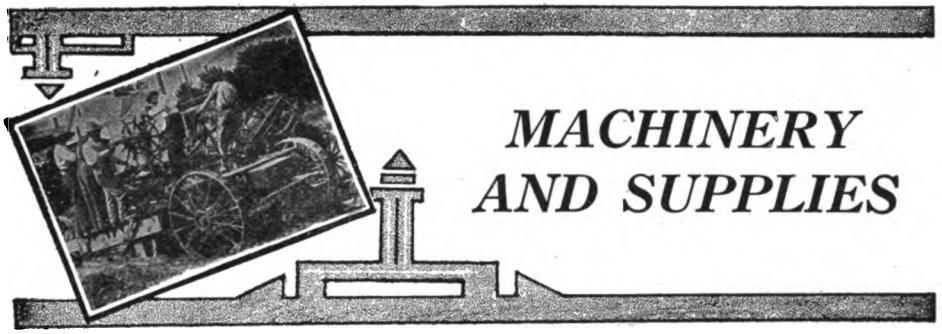

A Snow Plow For Street Use

In these days of heavy snowfall the Twentieth Century snow plow, sidewalk and gutter cleaner is a machine of much interest. It is a snow plow, throwing snow in either direction, as it may be set, which cuts down to the pavement beneath, leaving it practically clean. There are one-horse and two-horse plows or graders, which can be used to clear sidewalks, gutters or street car tracks or to throw snow into windrows for removal by wagons. In one town it saved one-third the cost of cleaning cross-walks of snow by hand. In another northern Minnesota town, with heavy snowfall, one man with team and plow kept clear seven miles of sidewalks, six feet wide.

All the levers for handling the machine are in direct reach of hand or foot of the driver on his seat.

By changing blades the machine can be used as a mud scraper, ice scraper, stone spreader, ditcher and road grader as well as snow plow.

The Baker Manufacturing Co., Springfield, Ill., will give full details on application.

Sand Spreader for Pavements

City officials who are troubled with slippery streets, so common at this season of the year, should examine the Kindling sand spreader, which will cover such pavements with a thin, uniform layer of sand or gravel. Some cities try to cure slippery streets by hand-spreading of sand and some are prevented from trying this method because of lack of funds to meet the expense. The Kindling sand spreader will sprinkle 50,000 square yards of pavement per hour with sand or gravel, doing the work of fifteen or twenty men. Some materials will scatter farther than others, but this spreader will cover at least 20 feet with any suitable material, and from 50 to 60 feet with others. A lever regulates the flow of sand or gravel and the rate of scattering, and the driver operates the lever, so that but one man is needed.

Any materials from the finest sand to 1¼-inch stone can be handled by the machine. It is made by the Kindling Machinery Co., Milwaukee, Wis., the well-known makers of the Kindling squeegee for scrubbing city pavements.

Medusa Waterproofing Patent Sustained

The United States Court of Appeals, Seventh Circuit, rendered a decision on January 4, 1915, fully affirming the decision of the United States District Court, Northern District of Illinois, rendered February 13, 1914, by which the Newberry patent No. 851247 was declared to be good and valid, and that the McCormick Waterproof Portland Cement Co. infringed said patent. This is the patent on Medusa water-proofing for cement, made by the Sandusky Portland Cement Co., Sandusky, Ohio.

Old Block of Concrete from Panama Canal at Chicago Cement Show.

A cube of the first concrete made by the old French Canal Company in 1886 has been received in Chicago for exhibition by the Universal Portland Cement Company at the eighth annual Chicago Cement Show, February 9 to 16, in the Coliseum.

Altho the old concrete was formed in blocks like cut stone and not made monolithic, as in all the later construction, its endurance under severe weather conditions is remarkable. The materials used were a portland cement, Bohio rock and Panama beach sand.

In quoting the specifications under which this concrete was made Colonel Geothals says: "The Bohio rock is volcanic agglomerate of rather low specific gravity and medium hardness, but very resistant to atmospheric weathering. Dur-

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ing severe "northers" the breakers have, sometimes, been strong enough to roll the blocks upon the beach." The French records of the contract of 1886, under which these blocks were made, contain the following specifications:

"Stone to pass through a ring 0.06 m. diameter, and to be washed and screened to eliminate all particles smaller than 0.02 m. diameter. The cement mortar to be composed of 800 kilogrammes of cement to 1 cubic meter of sand. These materials to be mixed dry upon a wooden platform under a roof, and water to be added by means of a sprinkling hose, taking care to use only as much water as may be necessary to produce a homogeneous mortar, which will stick to the shovel. The concrete to be composed of two parts of mortar and three of stone. After the mortar shall have been mixed as specified above, add the stone and mix with an iron hoe, until all of the stone shall be completely covered with mortar; the mixing to be accomplished without further addition to water, the stone, however, to be watered carefully in the pile at least one hour before using. The concrete to be dumped into forms and compressed to a compact mass. Repeated ramming to be carefully avoided."

NON-SLIP WOOD PAVING BLOCKS *with inserted steel strip. Outside line shows exact size and shape.*

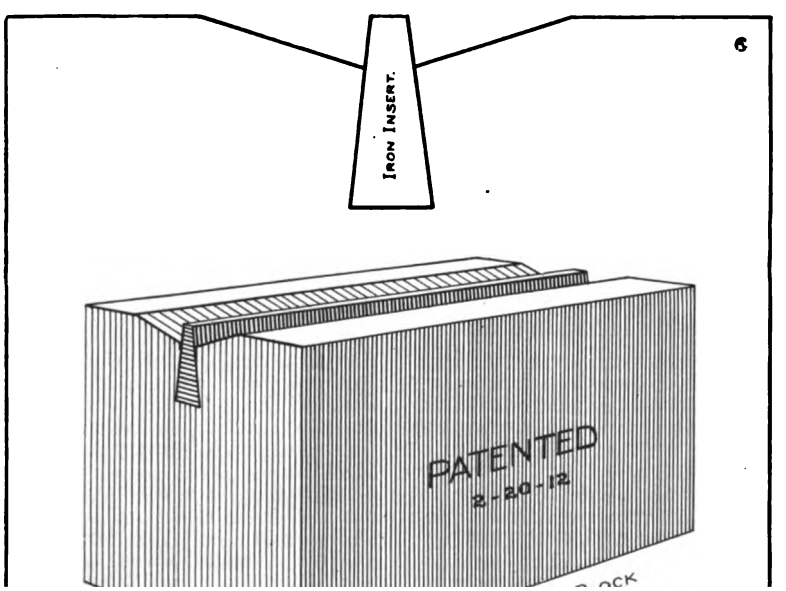
A Non-Slip Wood Paving Block

A type of wood paving which has been laid successfully in Boston and Philadelphia is designed to prevent the slipperiness complained of in certain wet or icy weather when a pavement is laid of rectangular creosoted wood blocks with smooth surfaces and close joints.

One of the accompanying drawings shows by its outside line the full-sized end of a block, from which it will be seen that its distinctive feature is a hollow in the upper surface with a re-entrant groove, in which is inserted an iron bar of trapezoidal section.

The inner drawing is an isometric projection of a completed block showing the special characteristics still more fully.

The blocks have been laid on two streets in Boston, where they have been in use for over three years. The pavement on Washington street, Dorchester district, is on rather heavy grade. More than 50,000 of the non-slip blocks were



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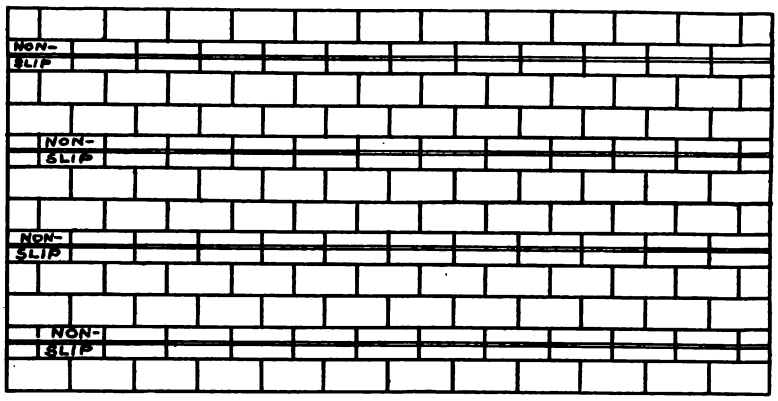

NON-SLIP WOOD PAVING BLOCK *pavement, showing one row of non-slip blocks to two rows of common blocks.*

used on this street. The advantage to horses in preventing slipping are obvious, as they can secure firm, solid hold in pulling up grades. On a Philadelphia pier the blocks give horses the same advantage in starting heavy loads.

The second drawing shows the method of laying, the rows of blocks being laid perpendicular to the length of the street and non-slip blocks being used in every third row. Where deemed necessary they can be used in every second row.

As it takes forty 4 by 8-inch blocks to lay a square yard of pavement, 13 1/3 non-slip blocks and 26 2/3 plain blocks will be required for a square yard laid as shown in the design. If the non-slip blocks are laid in every second course half the blocks will be non-slip, and if in every fourth course one-fourth the blocks will be of the non-slip design. These blocks are, of course, more expensive than the plain creosoted blocks and the number of courses between courses of non-slip blocks will be chosen according to the necessities of the case as to accommodation of traffic on one side and as to cost on the other.

The Acme non-slip wood paving block is put on the market by the Philadelphia Wood Paving Block Company, Philadelphia, Pa., who will answer questions regarding them.

How Goodrich Tire Makers Went to War

War, and its effect on the tire industry of Europe, is graphically described by Arthur Lumsden, general manager of the French and English auxiliaries of the B. F. Goodrich Company, of Akron, Ohio, in a recent number of *The Automobile*.

"Our men had been paid as usual at noon on the Saturday France mobilized her army," Mr. Lumsden says. "At 4:30 o'clock the notices were issued putting the nation on a war basis. As our pay list is made up on Wednesday evening, arrangements were made for the cashier to be at the office on Sunday morning at 5 o'clock, in order that the men who were going to the front could collect their arrears of wages. In this way every man who left our works to go on active service went away fully paid.

"On Monday morning I was curious to see what the conditions would be at the factory. We found we had eighty men who were not eligible for active service. These men included most of those engaged in the band tire department. According to a previous arrangement with the French government, this department went under military control automatically as soon as war was declared, and we were put under an obligation to produce certain quantities of tires for army trucks." (This arrangement, it should be explained, is a part of the French army subsidy scheme. A couple of years ago Goodrich tires were admitted as part of the equipment of army subsidy trucks. Only the fact that the Goodrich company actually manufactures in France and has on its French board of directors men who have military responsibilities under the French law enabled this arrangement to be made.)

"London and Paris were violently panicky as soon as war broke out. The leading French tire firm, doing an immense business in England, called in all its stocks and refused to do business on anything but strictly cash terms. This move was followed immediately by the leading English firm. Dealers were decidedly annoyed at this action on the part of the heads of the French and English tire in-

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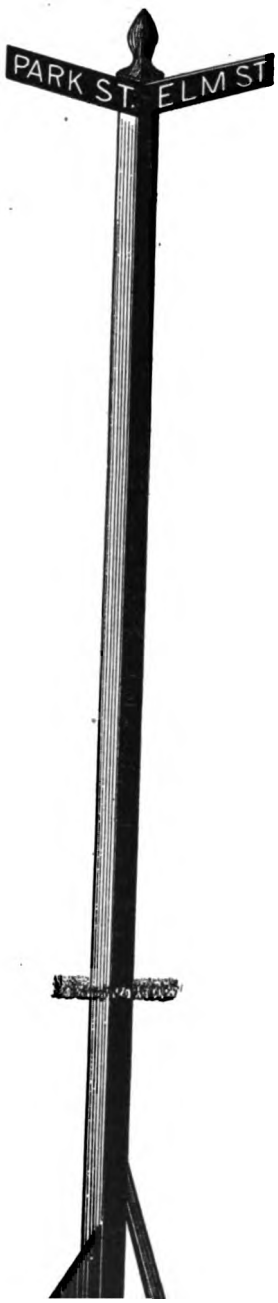
dustry and expressed their dissatisfaction so forcibly that at the end of a couple of weeks the English company resumed business on the original basis. The curious feature of the situation is that both these companies took advantage of the patriotic wave, announcing 'Business as Usual,' 'Follow the Flag,' 'Stand by the Old Country,' 'Support British and French Industries,' etc.

"Practically our entire stock of tires, both at the factory and at the Paris stores, was requisitioned by the government. These tires were left in our hands, but could not be sold to the public, the army having the right to call for them at a moment's notice and pay for them according to a pre-established tariff, which is practically the price paid by dealers. There was no interruption in the production of band tires for trucks, but practically all we produced were taken up by the army. The strict regulations under which we have existed for a couple of months have been somewhat relaxed of late. We have been able to begin, on a small scale, the production of pneumatic tires, and also to offer some of our stock to the public. It is expected that within a few days arrangements will be completed whereby we can export to England, and thereby supply the European countries not involved in the war. We have continued to do a certain amount of business with those parts of France not occupied by the armies, but the difficulty here has been the lack of shipping facilities. We have never experienced any difficulties with regard to the supplies of raw rubber and fabric."

Street Sign Post

The accompanying drawing shows a very simple and comparatively inexpensive street sign post which has been introduced by the Enameled Steel Sign Company, 222 North State street, Chicago, Ill. This post is intended for use in parkways or lawns along the curbs of streets, and is one of several designs for various purposes and locations which the company has made.

The post is an angle-iron bar 2½ by 2½ by 3/16 inches, of the proper length to hold the signs 7 or 8 feet above ground, and to attach the anchors underground at depth enough, 30 inches, to keep the post upright against ordinary action of frost and shocks less than a runaway team or an automobile would give.



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horizontal flange. A 3/16-inch triangular plate is riveted to one flange of the angle iron and a brace to the other as shown in the drawing. If deemed necessary this base can be set in concrete to protect the post from rust and to give it more weight and stability.

This post is now in satisfactory use in Gary Ind. It costs $1.90 in lots of 100 or $1.70 in lots of 200. Further information will be given by the company above referred to if desired.

Corrugated Iron Culverts Convenient of Removal

These American ingot iron culverts offer all the advantages of the most approved culverts, with the additional merit of being light and easily transported to the place of installation, no matter how inaccessible.

They are most easily and quickly placed in position, and do not require the services of skilled labor. There is no element of chance connected with the use of these culverts, because there is no uncertainty as to them. There can not possibly be any question of structural weakness, inaccuracy of labor, defective materials. They can not come to you chipped in transit or with broken flanges. Coming in any required length or diameter, they may be placed in position with none of the difficulties incident to setting of joints with cement grouts, bracing against slipping and sliding while the joints are hardening, or any such common difficulties.

They possess another advantage not to be had in connection with the use of any other culvert material, namely, removability. By this we mean that these culverts may be taken out and reset, as may be desired when the grades of the roads are changed or the location of culverts is to be altered. There is nothing about them that requires any element of destruction, breakage, disconnection of attachment, or other sources of uncertainty, risk or complicated labor. For the private place, the farm, the park, or the public institution, summer resort, or cemetery, "Armco" culverts are peculiarly well adapted, inasmuch as such places are subject to frequent changes of landscape treatment, road and driveway construction and extension and the like. The lightness and inexpensiveness of this material renders it indispensable for these purposes.

For storm drainage of city streets a special form can be used, saving head room, but not at the expense of strength. This is the part-circle culvert of the National Corrugated Culvert Co., an example of which from Douglas, Ariz., is shown in the accompanying photograph. This culvert has a 78-inch base and 34-inch rise and carries storm water only.

The Proper Care of Lawns

The season for caring for lawns, golf courses and the like is at hand, and park and other officials should investigate and secure the best machinery for the purpose. The Velvetlawn line of grass and

PART-CIRCLE CULVERT *of corrugated in Douglas, Ariz., 78 inches by 34 inches.*

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clover drills and seeders, both hand and horse drawn, is worth investigation. The Velvetlawn Seeder Co., Springfield, Ohio, will send on request a booklet on the proper care of lawns, as well as catalog and price list.

Universal Portland Cement Company at the Eighth Chicago Cement Show

Practice in the field of concrete construction progresses so rapidly from year to year that the Universal Portland Cement Company annually avails itself of the offortunity for presenting new ideas at the Chicago Cement shows.

REMOVING SLAB OF CONCRETE *from Bellefontaine, Ohio, pavement for exhibition purposes.*

Much space in the eighth Chicago Cement Show will be devoted to showing the need for clean sand, stone and water, properly graded and selected aggregate and the need for thoro mixing and curing of floors, block, and tile. Various types of cement products properly made and cured will show the strength and water-tightness obtainable with good concrete. Specimens of factory floors cast in three sections will indicate good and bad methods of construction.

The good roads exhibit will include a model of a concrete road under construction showing the position of the mixer and the distribution of the working force. All details involved in the construction will be shown, including a section of the old dirt road upon which the concrete road is placed, a finished section of the concrete road itself, dirt covering for curing, stone shoulders along the finished section, pipe line for supplying water for mixing and sprinkling, and all the machinery and implements.

A section of the Bellefontaine, Ohio, pavement, laid in 1894, will be shown again. The original specifications for this pavement show many points of similarity with present-day best practice. A section of pavement from Woodward avenue, Wayne County (Detroit), Michigan, which was removed to permit making a suitable joint with the new Seven-Mile road, recently completed, will also be shown.

One of the many advantages of concrete roads is the fact that this type of pavement permits of building the concrete curb integral with the pavement itself. Charts show the usual construction, and others the approved practice of concrete paving between street car tracks.

On Twenty-first street, near the lake, is a two-course reinforced concrete pavement built to carry heavy traffic. From 1908 to 1913, a total of 129,744 square yards of concrete alley pavements were laid in Chicago. In 1914 alone the yard-

MODEL OF CONCRETE ROAD *under construction which will be a prominent feature of the exhibition.*

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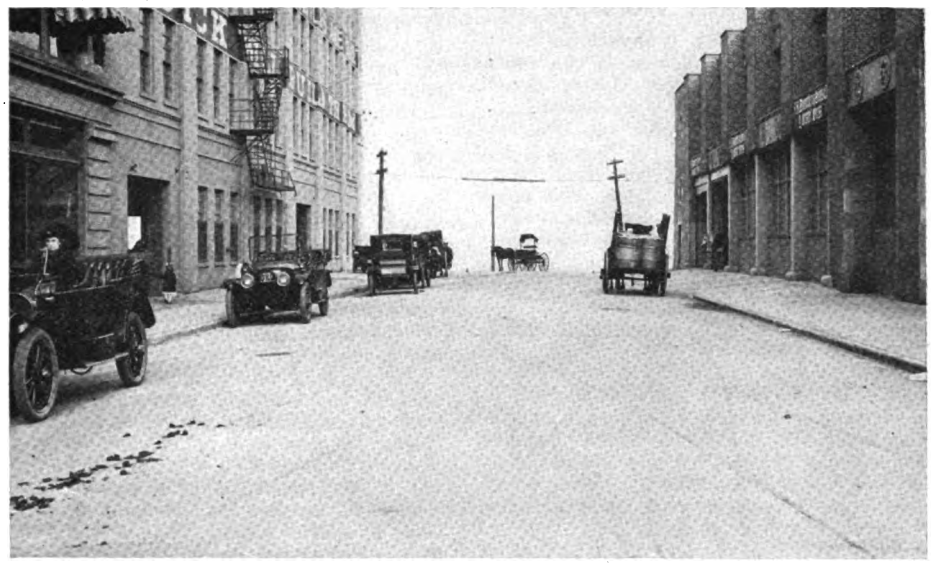


TWO-COURSE PAVEMENT *for heavy traffic on Twenty-first street, near the lake, Chicago.*

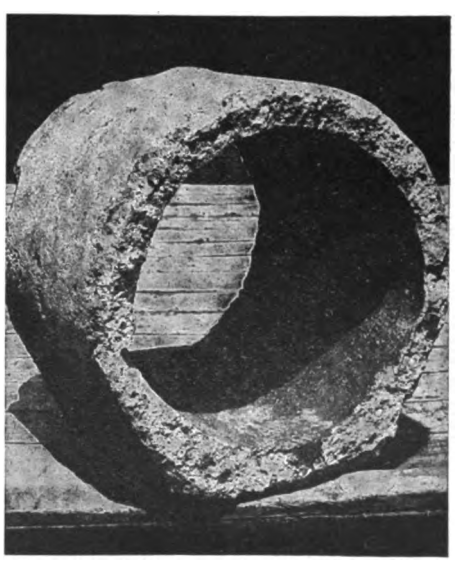
age approximated 125,000. Immediately outside of the city limits are many excellent types of country concrete roads.

One space will be devoted to the fireproofness of concrete. Its central feature will consist of transparencies showing the most striking scenes at the Edison fire, around which will be grouped smaller transparencies showing several pictures of this conflagration. Accompanying this will be an illuminated letter from Mr. Edison indicating his attitude toward concrete, his plans for rebuilding in concrete and an expression of his satisfaction in the manner in which his buildings stood up during the severe conflagration. The Salem fire will be treated in a somewhat similar manner.

The booth devoted to a portrayal of old concrete specimens will contain sections of concrete from Pompeii, Rome and Colon. A piece of concrete cut from a Nova Scotia bridge pier, cast in 1884 and subjected to tidal action ever since, will show how well concrete withstands such severe tests. Of less historical interest but of equal value in showing the permanence of concrete are sections of a street crossing laid in a North Dakota town in 1864, and used continuously for 30 years, a concrete block with granite facing subject to about 10 years of weathering, a 47-year-old piece of sewer pipe from South Bend, Ind., and a piece of sewer pipe from Bay City, Mich., more than 45 years old.

Concrete on the farm, in the garden, in decorations, will be shown. The economy of bulk cement will be demonstrated in one exhibit.

SECTION OF 45-YEAR-OLD CONCRETE PIPE *removed from Bay City, Mich., sewer to permit enlarging it.*



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The Complete Workshop

Among the recent innovations calculated to arouse the interest of the educational world is a new workshop bench, known as "The Complete Workshop."

Almost every instructor has felt the need at some time or other of a small shop suitable for doing almost any kind of work, but in a great many cases space or the high rental cost of additional space forbids the installation of the necessary machines. The Complete Workshop has been designed for the purpose of obviating these difficulties, and making it possible to do all sorts of work in the educational line within the most limited space. Within a space slightly larger than the ordinary laboratory work bench would occupy are facilities for repairing and manufacturing which heretofore have required many times this space. The outfit is quite as well adapted for small manufacturing or repair work in connection with workshop or salesroom.

The polishing-dust collecting outfit forming the main part of this machine is exceedingly useful, not to say essential in the make-up of every workshop in the educational line, and especially to a shop connected with an ordinary salesroom or retail store. The use of this machine makes it possible to have the stock always looking fresh and bright by preventing the dust and dirt from flying all over the place. When repair work is done that requires buffing, the small particles of precious metals which are removed in this operation do not float away thru the air, but are drawn in by the powerful suction of air at both of the hoods, shown in the illustration, and deposited in the tank underneath the bench to be recovered subsequently and refined. Heretofore this material has been a total loss, but now it is possible to retain it and recover its value in new gold or other precious metals.

The drilling machine which is fitted with a high-grade chuck is capable of accommodating drills from 0 up to 5/16 inch. On the under side of the bench and fastened thereto is a pressure blower with the necessary pipe connections running over to the left-hand side of the bench, where arrangements are made to connect the air supply to the furnace, as shown on the iron stand alongside the bench, or in its place the sand blast shown underneath the furnace may be connected and used whenever required. It will be noted that all of these machines are connected by belts to the shafting shown on the lower platform, which in turn is operated by the motor hanging underneath the bench.

The motor supplied can be attached to electric lighting socket, and will give ample power to drive either of the individual machines, and is so arranged as to make it possible to operate them individually. The furnace table, as shown, is a separate table, which can be placed at the side of the polishing machine, or at any other part of the room. In this latter case it will only be necessary to increase the length of hose to carry the air.

The suction on the dust collecting outfit

COMPLETE WORKSHOP *for use in small shops or stores, for educational purposes and home work.*

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is so arranged that by an arrangement of dampers an increased suction may be secured at either hood, according to the one that is being used. It will be noted that the machine is supplied with a small dust hood on one side, which may be used for small work, while on the other side a larger hood is shown, which is utilized when larger pieces are to be buffed.

The polishing head shown may be fitted with chucks for different purposes, such as sawing, turning, lapping and other operations.

The shaft bearings of the machine are self-lubricating, as also are the bearings of the pressure blower and motor. The bench is zinc-lined, so that it is easily kept clean, and the entire outfit may be operated from an ordinary electric light socket.

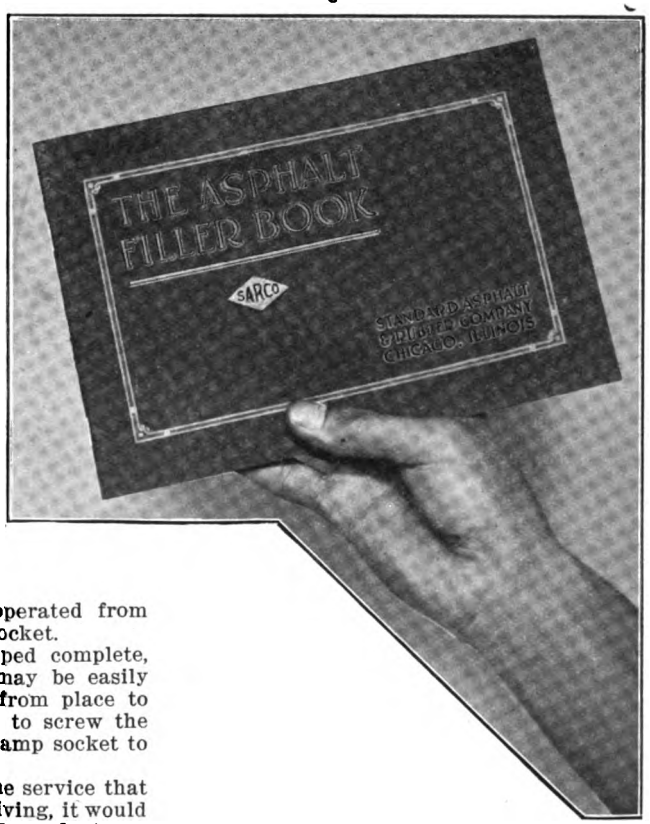
The entire outfit is shipped complete, set up ready to run, and may be easily handled and moved about from place to place. It is only necessary to screw the electric light plug into the lamp socket to begin work.

In order to secure the same service that this machine is capable of giving, it would be necessary to purchase independent machines which would cost a great deal more than this combination outfit costs, and it might be mentioned here that the cost of the outfit is very reasonable, so that a great demand is looked for among retailers, and especially among small repair shops.

The outfit is adapted for those doing small work as well as for educational work, and all of the different parts which are supplied with the machine are standard, well-constructed machines, and not in any sense experimental. The entire machine is substantially built and nicely finished, and its cost is very reasonable. The manufacturers of the outfit, Leiman Bros., 62 John street, New York City, will supply any additional information and prices for the outfit, which is the result of their twenty odd years of experience in manufacturing machinery.

Asphalt Filler for Brick Pavements.

The "Asphalt Filler Book," the outside of which is shown in the accompanying photograph, gives full information about the use of Sarco asphalt as filler for block pavements. Specifications for fillers for various kinds of blocks and the various methods of applying them are fully stated. The quality of the service rendered by the booklet can be judged by the extracts from it made in the department, "From Workers in the Field," elsewhere in this volume.



Fiber Conduits

In the process of manufacturing Orangeburg fiber conduit wet wood pulp or fiber is wrapped in a minutely thin film upon a forming mandrel, under pressure, until the desired thickness of wall is obtained. The individual fibers become felted and form a solid, homogeneous wall. Taken off the mandrel, the wet pulp structure is subjected to a drying process, after which it is placed in a vat of liquid compound. This compound is a preservative and is also insulating and water-proofing. It thoroly permeates the entire structure, so that after treatment the wall of the conduit, when cut, presents a strong resemblance to hard rubber. The ends are cut in a lathe to make a socket joint,

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sleeve joint or screw thread, as may be desired.

The same materials and general process are employed in producing bends of various degrees and radii, "S" bends, tees, elbows, crosses, couplings and junction boxes, with the varying number of outlets.

Stock on hand is stored winter and summer in the open yards of the manufacturing plant, the manufacturers thus demonstrating their confidence in the quality of the water-proofing and the perfection of the resistance of their product to the weather.

The third edition of the catalog of the Fibre Conduit Co., Orangeburg, N. Y., shows the many methods of installing the conduit pipes in the construction of multiple conduit lines for electric wires and cables. It also shows special uses for which the Orangeburg conduit is fitted on account of its resistance to corrosion by acids, weather, etc., and its strength, such as leaders to carry water from roofs, wall bushing for carrying cable and the like thru walls, conveying dilute acids, alkali or corrosive salt solutions, vinegar, etc., chemical containers, laboratory hoods and drainage channels, etc.

Single House Sewage Disposal.

Isolated country houses are sometimes confronted with the problem of sewage disposal, especially in these days when water supplies are ample, thru the use of wind mills or gasoline engines for lifting water, and the comfort of the dwellers in the house is duly considered.

Suburban houses to which the city sewer systems have not been extended, tho water pipes have reached them from the city supply, are in even more urgent need of a local method of disposing of sewage.

There are many small towns which have ample water supplies, but which have not yet had sufficient demand to warrant the construction of sewer systems because of the long lines necessary to reach all the residences and the consequent excessive expense.

All these classes of houses need residential sewage disposal plants. Quite a number of engineers design such plants upon request and have met with success in such practices. One of the engineers longest devoting himself to this kind of work and having one among the largest lists of successful plants to his credit is Burton J. Ashley, who, some years since, devised a simple and comparatively inexpensive plant, which he keeps fully up to date. The Ashley Sewage Disposal Company, Morgan Park, Chicago, Ill., is prepared to design and install such plants with full knowledge of the varieties of conditions met with, so that they should be able to meet any demands made upon them.

The Wonderful Growth in Wood Block Paving

By E. W. Church, Philadelphia, Pa.

Wood paving blocks, as we know them to-day, were but little used prior to 1900. A few cities had put down trial sections of wood block paving, but in each case the local engineer had worked out his own plan, no scientific data being available at that time.

From 1900 to 1908 the gain in wood block pavement was slow, the cities adopting this kind of pavement with great caution, but at the latter date the city engineers began quite generally to exchange data, and in consequence found that the laying of wood block pavement need not be wholly an experiment.

During 1908 some thirty cities laid wood block pavements, the amount laid in that year being about 800,000 square yards. From then until now there has been a constant increase in this pavement, and we find at the beginning of this year 150 cities using the wood block pavement, the amount so far laid being fully 10,000,000 square yards.

While there is much yet to be learned regarding treatment of blocks, method of laying, etc., the city engineers can now quite accurately determine the kind of wood best adapted, the proper amount of creosote saturation per cubic foot, and the best method of laying.

Ten million square yards of wood block pavement means that we have used up for this purpose practically 400,000,000 feet of merchantable lumber. At least 50,000,000 feet of lumber will be used up in wood block pavements during 1915. This brings us face to face with the great problem of to-day: The conservation of our timber.

Trade Notes

Among the contracts recently awarded to the Raymond Concrete Pile Co. are concrete piles for the foundation of a new power house for the Victor Talking Machine Co., Camden, N. J., and reinforced concrete ore trestle for the Maryland Steel Co., Sparrows Point, Md.

The Bessemer Limestone Co., Youngstown, O., sends a wall calendar for 1915 which cannot fail to find a conspicuous place in any office receiving it.

The International Engineering Congress will be held in connection with the Panama-Pacific Exposition at San Francisco, September 20-25. Memberships and subscriptions to the volumes of proceed-

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ings are now being received by the secretary of the congress, Foxcroft Building, San Frnacisco, Cal.

Marconi trans-oceanic wireless telegraph is now in successful operation between San Francisco and Honolulu and has caused a reduction in cable rates to the basis of its own rate of 25 cents a word.

The F. D. Cummer & Son Company have just been awarded contract by the Boro of the Bronx, New York City, for a Cummer road plant with a guaranteed capacity for turning out 750 square yards of 2-inch top asphalt macadam or Topeka mix per day. This plant is to be erected ready for operation in the early spring.

The MacArthur Concrete Pile & Foundation Company, New York, has been awarded contracts for the foundation of the boiler house at the Portland (Me.) Gas Light Company plant; for pedestal concrete pile foundation for the State Hospital laundry building, Toledo, Ohio; for concrete piles required for the bridge over the Susquehanna river at Nanticoke, Pa.; for the foundation of the United States government post office building, Augusta, Ga. Waldo Bros., 45 Batterymarch street, Boston, Mass., have been appointed their sales agents for New England.

The Westport Paving Brick Company of Baltimore, Md., and the Mack Manufacturing Company of New Cumberland, W. Va., have become licensees of the Dunn Wire-Cutting Brick Company for the manufacture of wire-cut-lug paving brick.

Trade Publications

Ornamental concrete lighting standards for artistic illumination of business and residential streets, parks, private grounds, etc., are handsomely illustrated in a circular of Morrison & Quinn, manufacturers, Rochester, N. Y.

Connersville cycloidal pumps are the subjects of Catalog 16 of the Connersville Blower, Co., Connersville, Ind.

The Society for Electrical Development has prepared a booklet on electricity in the home, which can be used by its members as advertising literature to promote the use of the many household appliances now on the market.

A new booklet on "Disposal of Waste

The American Telephone Fire Alarm Co. has developed a fire-alarm system which is revolutionizing the alarm section of fire prevention. Its simplicity and ease of operation and maintenance are unsurpassed. It is described in full in the publications of the company, which will be sent on request from their office, 10 South La Salle street, Chicago, Ill.

Catalog 805 of the Studebaker Company is devoted to bottom dump wagons and dump boxes, of which this company makes a line which has long been the standard. The catalog goes into full detail of all parts and all designs and styles, and will be sent on application to the company at South Bend, Ind., or to any of its numerous branches.

A treatise on steam boilers and boiler feed water is issued by the American Boiler Life Co., Boston, Mass.

The Armco Culvert Publicity Bureau, 2101 Union Central Life building, Cincinnati, O., publishes an excellent article on "Corrugated Iron Construction on the Sacramento Valley Irrigation Project," which is by Eugene C. Mills, engineer of the Sacramento Valley Irrigation Co., which will be sent on request.

The Foster valve specialties of the Foster Engineering Company, Newark, N. J., are fully shown, listed and priced in Catalog No. 20.

Indiana Limestone, "the aristocrat of building materials," is the title of a handsome descriptive booklet, fully illustrated, issued by the Indiana Limestone Quarrymen's Association, of Bedford and Bloomington, Ind.

Sauerman Bros., Chicago, Ill., issue a fully-illustrated booklet on the Shearer and Mayer dragline cable way excavator, which seems to be one of the most popular of the excavators of this type now on the market.

The Harris Patents Company, New York, issue a catalog of a valveless engine which has some points of notable advantage.

The monthly publication of the Sandusky Portland Cement Co., always has descriptions and photographs of interesting architectural and engineering works in which Medusa portland or white cement has been used.

Willis Shaw Machinery Co., New York Life building, Chicago, Ill., publish a

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A new folder shows the latest product of T. L. Smith & Co., Milwaukee, the Smith mixerette, which takes a batch of 5 cubic feet of loose sand, stone and cement and mixes 40 to 60 cubic yards of concrete per day.

It required a panoramic photograph 6 by 36 inches, crowded full of faces, to show those present at the general sales conference of the Goodyear Tire and Rubber Co., at Akron, O., on October 30.

A recent booklet of the Sandusky Portland Cement Co., Sandusky, O., is a handsomely illustrated demonstration of the wide and successful use of Medusa waterproofing, manufactured by this company for The Medusa Waterproofing Co.

Catalog 58 B of The Van Dorn Iron Works Co., Cleveland, O., is a fully illustrated exposition of their systems of steel jail and prison cells, keyless locking device for sliding cell doors and interlocked and counterlocked grating construction.

G. H. Atkinson Co., 30 Church St., New York, have a new circular regarding their "Torpedo" scarifier for road surfaces.

The Koehring Machine Co.'s Chicago district manager is out with a hurry-up circular on "War with the Elements," giving the advantages of hurrying up fall work with a Koehring mixer.

The United States Tent & Awning Company, Chicago, has a new catalog and price list of all sorts and sizes of tents, balloons, chairs, seats, benches, tables, lights, cots, flags, oiled clothing and other goods for outdoor use.

The embargo on crude rubber from English possessions has been raised thru negotiations with the English government by the government of the United States and representatives of the manufacturing companies, and new shipments have begun to arrive, with consequent reduction in price of rubber and protection of prices for tires.

The Sandusky Portland Cement Company, Sandusky, Ohio, is distributing an edition in Spanish of its booklet on Medusa White Portland Cement.

A booklet illustrating and describing the processes of making Youngstown quality pipe, lap and butt welded wrought iron, is issued by the Youngstown (Ohio) Sheet and Tube Company.

The Van Dorn Iron Works Company, Cleveland, Ohio, have at least two lines of manufacture of interest to public officials. One of these is their patent prison and cell construction, using their tool-

ment stores, factories, private estates and small cities and towns are built by the Atkinson-Morse Company, 30 Church streets, New York City, who will send booklets descriptive of the same on request.

The Buckeye Engine Company, Salem, Ohio, issue a booklet about their compact steam engine and boiler for contracted space. They claim for their designs of power plants half the coal, half the floor space and half the labor of many other steam plants. They also make gas engines and the Buckeye-mobile.

Much of the Grinnell Automatic Sprinkler Bulletin for January is taken up with the story of the fire in the Edison plant and how it might have been saved by the use of automatic sprinklers.

The Reid incinerator is briefly described in a booklet by the A. H. Reid Incinerator Company, 69 Rowanwood avenue, Toronto, Ont.

Clifford Richardson, New York, has published in a booklet a brief article on "Stone-Filled Asphalt Surface or Fine Asphalt Concrete."

The Koehring mixer booklet for January has been received from the Koehring Machine Company, Wilwaukee, Wis.

The Universal Portland Cement Company, Chicago, Ill., publishes a handsomely illustrated series of booklets on Concrete Roads which gives much valuable information.

Standard reinforced spiral pipe is detailed in catalog No. 4 of the Standard Spiral Pipe Works, Chicago, Ill.

The Blackmer & Post Piper sounds the merits of Blackmer & Post vitrified pipe, made in St. Louis, Mo.

The Red Book of the United States Gypsum Company, Chicago, Ill., will be mailed on request to any one wishing full, authoritative information on gypsum and its products, such as wall plaster.

Studebaker catalog 914 describes street sprinklers and sweepers, of which this company makes a standard line.

DeLaval centrifugal pumps, single and multiple stage, for all capacities and heads, are fully detailed in catalog B of the DeLaval Steam Turbine Company, Trenton, N. J., which sets forth their characteristics, design, manufacture, testing, selection and adaptation to various uses. Thre are special chapters on speed-reducing gears and turbine-driven water works pumps.

The third annual message of Rudolph

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Vol. XLVIII. No. 3 March, 1915. Twenty-five Cents.

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IN MUNICIPAL GOVERNMENT

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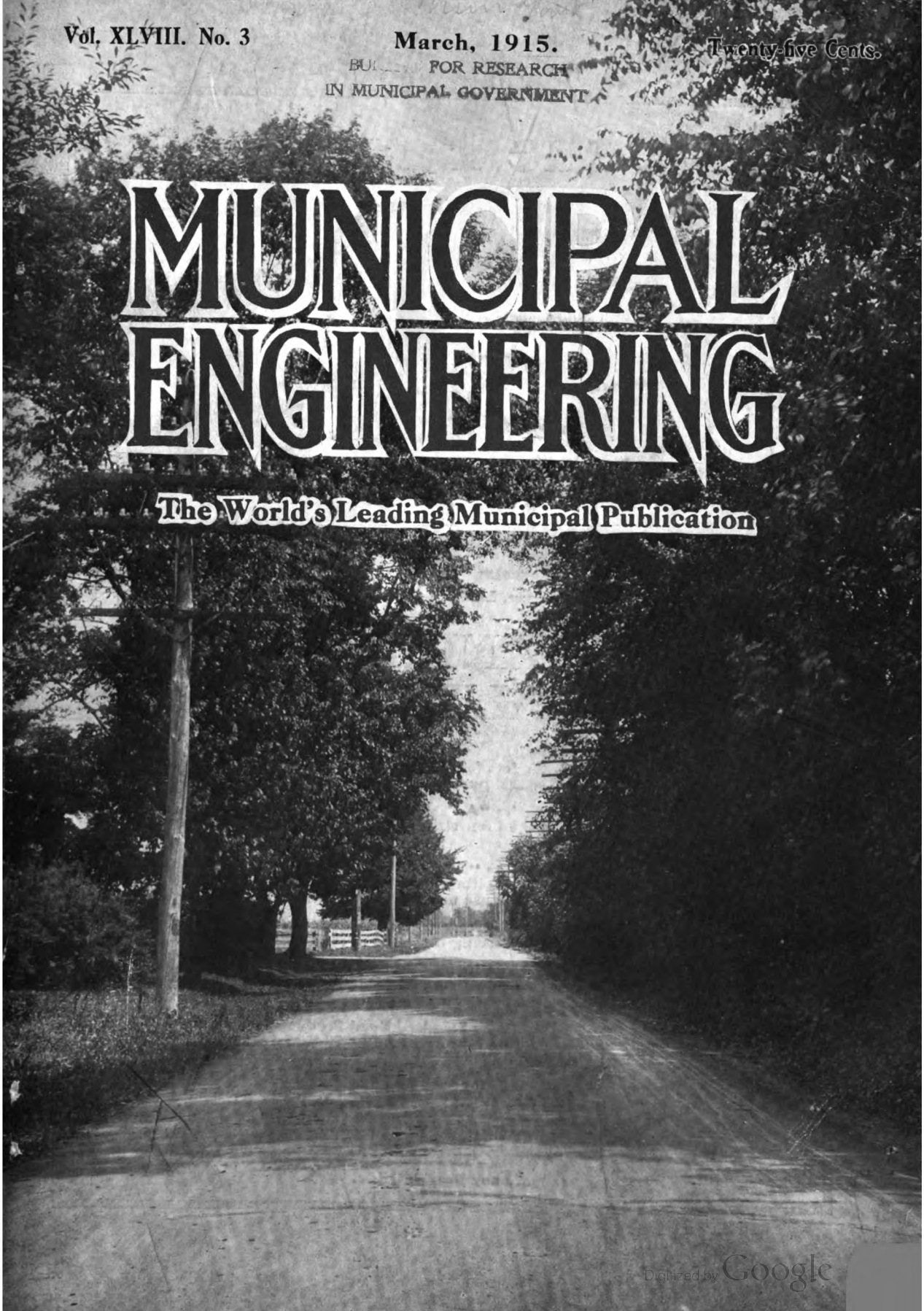
The World's Leading Municipal Publication



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Save the Pavements

Fifth Avenue, LaGrange, Ill. Built 1911.

STANDARD ASPHALT BINDER

Standard Macadam Asphalt Binders form a road that is waterproof, solid and durable; a road that keeps an even surface and remains free from dust.

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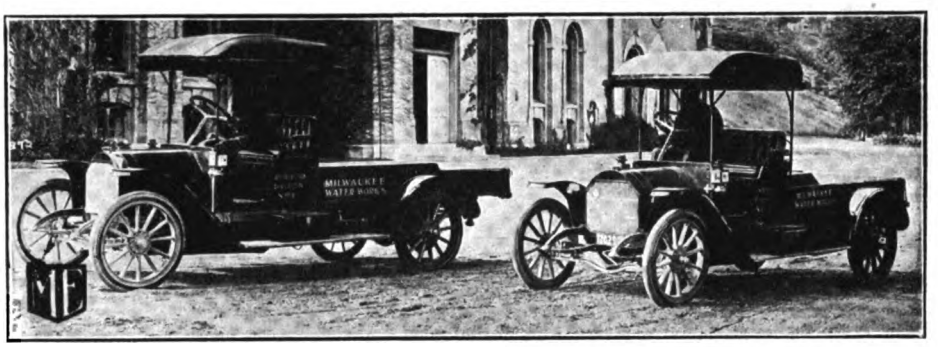

AUTOMOBILES IN THE MILWAUKEE WATER WORKS DEPARTMENT.

VOL. XLVIII. MARCH, 1915. No. 3.

The engineer's code of ethics can be comprised in a single sentence like this: "Act as a gentleman in every respect on all occasions; be just and generous to your brothers in the profession and do not hesitate to take the full responsibility for all your actions."—W. HILDENBRAND.

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THE JITNEY BUS

A NEW PROBLEM IN TRAFFIC REGULATION.

By Frank Reed, Los Angeles, Cal.

The jitney bus has spread like wild-fire over the country during the past six months and has become a serious problem in street traffic regulation, a nuisance at the same time that it gives a large measure of benefit to the patient strap-hanger who now, sometimes, can get a seat and make better time all at once. Probably the acute stage will be passed as times improve and other employment offers and as old cars wear out and their owners have not been able to make enough to buy others, but evidently there is a permanent use for the jitneys under some conditions in some places and at some times of day, the times of greatest congestion in street traffic. The problem of regulation will therefore not be so serious as it appears at this time. Up to the date of going to press no regulating laws or ordinances have actually been passed and put into force.

THE "jitney bus" is a contagious municipal affliction now in violent eruption on the streets of a constantly increasing number of cities. Its symptoms are well defined. First is the appearance of a rapidly increasing number of heterogeneous motor vehicles, usually worn or second-hand, and of the low-priced pleasure-car type, driven by men with an unkempt and worried appearance, who, by their activities, soon come to be known as "nickel chasers." The term "jitney" is slang for five cents, the price of a ride.

The next symptom is frequent irresponsible driving, an outgrowth of competition with one another, and with street cars, and a tendency to be careless of the rights and privileges in the streets of pedestrians, particularly persons intending to board electric railway cars. This recklessness and frequent defective condition of automobile equipment or ignorance of driving, together with traffic congestion, result in a notable increase of street accidents due to contacts between vehicles and pedestrians, or between vehicles and stationary objects or other vehicles.

The third stage is protest by the established electric railway companies against the "irresponsible and unregulated competition" of the jitney motor transportation, which, with all its defects, appeals to a very considerable riding public. Then comes the laying off of cars and curtailment of service on certain lines most affected by the jitney bus competition.

The next stage is active newspaper publicity and general public discussion of the good and ill aspects of jitney bus transportation, resulting in a demand for regulation. By this time the jitney bus drivers are formed into an organization and issues become fairly well defined, but bitterly contested, making regulation without precedents a difficult problem.

Los Angeles has been doing the heavy pioneering in working toward a solution of the jitney bus problem. The jitney bus originated in Phoenix, and was a good thing there, operating on streets not covered by electric railway service. Next it was heard of in Long Beach, where, in certain sections of the city, it supplemented with a needed transportation service the existing electric railway service, and then it was discovered that a $5 a month license would turn over to the

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TYPICAL JITNEY BUS *in use in Los Angeles, with sign. Note length of route.*

driver of a pleasure car in Los Angeles the privilege of peddling transportation, or soliciting riders, and operating between the heart of the business district and the principal residential sections along the level asphalt boulevards. There was a rush stimulated by lack of employment of automobile owners who had previously been working as salesmen, solicitors, collectors, etc., and also by the heavy number of cars in the second-hand market in a city where an average of one family in every five is an automobile owner.

The automobile dealers declare the jitney bus is a business anomaly—a business failure that is bound to stay. It is a business failure because only rarely can the operator peddle enough rides in a day to pay the operating and repair costs of his car, make an adequate allowance for the depreciation of the vehicle and pay himself a reasonable living wage on a 5-cent fare. The drivers, speaking generally, admit this themselves. What they are really doing is selling the residue value in old cars to the public in nickel installments, living on their cars, if they are their own, or making a bare living above the installments on the cars if they are bought on time from a second-hand dealer, until they can get some kind of a steady job. The men in the automobile trade point out that this kind of people and this kind of cars and conditions will be found in some cities all the time, and that as fast as one goes out of the jitney business his place will be taken by another. Of course the railways, being most hurt, are making the loudest protest. Unemployment of their men is created about as fast as employment is acquired by others in the jitney business.

The jitney drivers do not give a predetermined and regular service, either as to route or time schedule. It is urged that this will affect real estate values unfavorably.

The appearance of the jitney bus traffic in the business district produces an unfavorable impression on the average onlooker, which has led to objection by leading retail stores and hotels, and other business men. The street congestion is inconvenient and frequently dangerous to pedestrians at crossings, and to drivers of automobiles engaged in what automobile dealers and owners call legitimate use of the machine.

Jitney drivers early discovered that the money was in the overload, and the machines are crowded to a degree which can only be compared to the Brooklyn bridge crush in the old days. Little extra seats of board are installed in tonneaus, and in the rush hours passengers ride on the

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doors and the running boards. Twelve in a five-passenger Ford is no uncommon sight; a situation which has led to discussion of the need of regulation on social grounds.

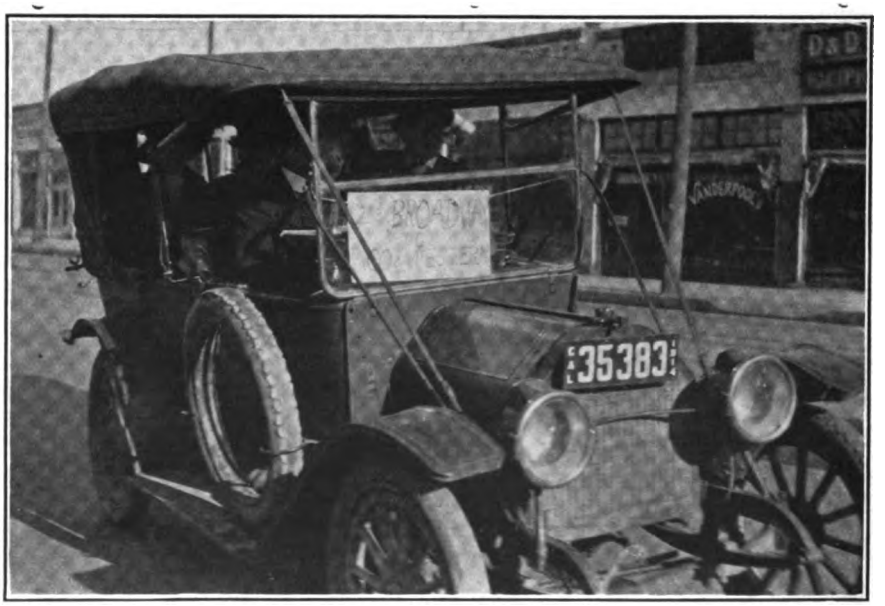
Congestion in the downtown blocks of the principal business streets is augmented by the establishment of safety zones at car-boarding points, which were rendered absolutely necessary by this new traffic. There is a general impression that the limit of street efficiency is exceeded by the addition of the jitney, of which over a thousand are now licensed in Los Angeles.

On the other hand, the jitney is being used by some thousands of passengers daily. Many of these are picked up in a moment of indecision by an alert nickel chaser, who drives up to the curb as they are waiting for a street car, opens his door and, as it were, scoops them into his car. Many others ride by choice. The chief attractions of the service are that it is a ride in an automobile with upholstered seats on automobile springs above rubber tires over smooth asphalt pavement; that the jitney acquires its load quickly, and most of the people unload near together, and there are comparatively few passengers per car anyway, so it gives an express service as compared with the frequent pick-up and let-down stops of the electric railway cars. Jitneys give fifteen minutes from some outlying districts, as against thirty for the electric car. Even when the tonneau is crowded there is some kind of a thing to sit on or lean upon for everybody, and as to the crowding, it is sufficient to remark that some people like a rough-house time anyway. So it appears that, however much electric railway people dislike it, the problem which confronts a municipality when the jitney comes is not one of elimination, or absolute suppression, but of regulation.

Probably the first consideration is that of street efficiency. This is tied up more or less with the question of what is a safe load for a jitney, and this in turn is rendered doubtful by the variety of types of vehicle. Light motor trucks, with bodies having a seating capacity of ten or fourteen pasengers, are coming into use to some extent, and pay better returns than other types.

The present tendency in regulation thought seems to be to permit but one

TAKING THE LAST WEAR *out of an old automobile by using it as a picker-up of transportation nickels.*



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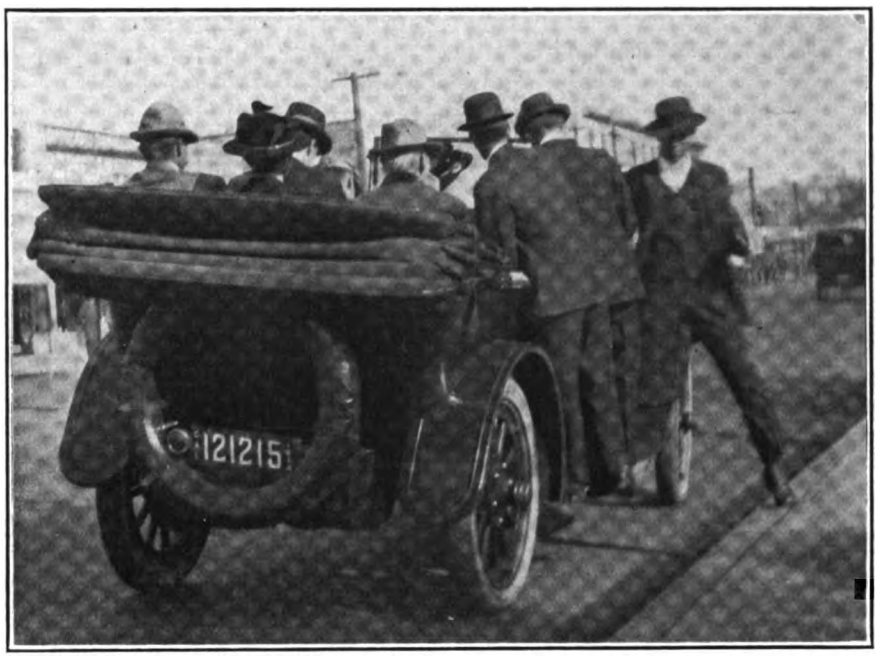

IT IS THE OVERLOAD *which seems to bring the profit, but excessive wear and breakages will soon tell a different tale.*

rider with the driver on the front seat, no riding on the running board, and to limit the load in the tonneau to two above its seating capacity.

Results of a brief study of traffic efficiency, under electric and jitney transportation, respectively, of the high-class business block in which the heaviest congestion occurs in Los Angeles, on Broadway between Sixth and Seventh streets, supply the following data: The length of the block, including crossings from outside of curbs, is 612 feet, width 56 feet from curb to curb. It is traversed lengthwise by double electric car tracks; electric cars cross at Sixth street and at Seventh, and there is a double track turn-off on some of the heaviest lines in town from Broadway to West Seventh. Safety zones are established by portable sign stands at the car-stop end of the block on each side, leaving room for one automobile to pass between the safety zone and the sidewalk.

During a heavy rush hour for all kinds of traffic, the street is packed full of automobiles and electric cars, with the congestion piling up and extending behind. Figures which show the reason for this and give a basis for comparison with figures which may be obtained in other cities, so that an estimate of the effect of a given district, are as follows:

Center entrance cars seating 50 are 46 introducing jitney bus traffic, may be made from a consideration of the street space and persons traveling to and from feet 7 inches long by 8 feet 5½ inches wide. Pay-as-you-enter cars seating 42 are 2 feet shorter. Figuring on the comfortable standing capacity, at the ratio of 66 seats per 100 passengers, determined as reasonable for the rush hour in a noted decision of the Wisconsin Railroad Commission, these cars should carry 75 and 63 passengers respectively in the rush hours. Twelve of the larger cars, the capacity of one track in the block, would load 792 passengers. Allowing longitudinal street space of 13½ feet for a Ford jitney, and figuring 7 passengers to the vehicle, not including the driver, the block full of jitneys, on one side in a single string, would load 45 with 315 passengers. As the jitneys are inter-

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spersed with privately operated automobiles, the paid traffic transportation capacity load of a block for electric car traffic is somewhere around four times the efficiency of the block for jitney traffic. If the jitneys were left to carry the traffic alone, they would smother one another out of business, or compel the building of subways.

The street railway companies insist that they cannot continue to operate if the jitneys are to skim the cream, that is, the rush hour and best route traffic, which makes up for the long empty hauls which regulatory ordinances force upon the electric cars.

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¶ THE CONGESTION OF TRAFFIC *is measured by the actual count of vehicles now necessary to carry the crowds and of capacity of the autos commonly used as jitneys.*

November 27, 1914, a traffic count at Seventh and Broadway, from 5 p. m. to 6:30 p. m., showed 345 cars passing that corner. Vehicles of all kinds, 1,533. Passengers on electric railway cars going out of town, 8,227. Cars going out of town, 191. Average load per car, 43. To transport the passengers carried by the cars would require 1,177 Ford automobiles carrying 7 passengers per auto, not including the driver. Allowing street space of 13½ feet per vehicle, which is 2 feet in excess of actual space covered, would make a string 3 miles long. Constant operation would require an incoming string of machines 3 miles long to keep up the procession, after the first 3 miles had loaded and passed out of town. To carry out of the city all the people the electric railway transports, in Fords at 7 per car, would make a line of jitney busses between 35 and 40 miles in length going, and an equal line coming. The railway does this with 17 miles of cars.

The effect on safety of street travel produced by the introduction of the jitney bus is indicated by statistics of accidents in Los Angeles, which show a sharp increase coincident with the development of this new type of transportation. Street accidents had been running slightly less than 400 per month in July, August and September. In October the jitneys began to appear, and street accidents ran up to 463. In November, new jitneys were going on every day, until, at the end of the month, there were about 700 operating, and accidents showed a cumulative increase through the month to a total of 601. The first eight days of December there were 8 accidents per day traceable entirely to jitneys. In the period November 17 to 28, out of 280 total accidents, there were 111 due to jitneys, which were only 3 per cent. of total vehicles. Accidents averaged 14.9 per day in October, and 23.3 per day in the last two weeks of November, with jitneys involved in 26 per cent. of the total.

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¶ STREET ACCIDENTS *are greatly increased by the increase in traffic, the competition for passengers and irresponsible drivers.*

Lieutenant Butler, of the police traffic department, in his official report attributes this definitely to "incompetence or recklessness or both in a large percentage of drivers," and suggests rigid examination of drivers, prohibition of riding on running boards, and limiting of operations to a stated route.

Control of the jitneys by the State Railroad Commission is advocated in some quarters. Such control, under the existing public utility laws, would require them to file and operate on definite schedules and routes, and they might start operations only after proving that public convenience and necessity required them to operate over a contemplated route.

In Los Angeles the mayor covers the situation by advocating an ordinance which would take the jitneys out of the four main streets in the down-town business section, thru the congested blocks, leaving them to operate on the parallel streets immediately outside. He says they should be required to have definite starting and stopping points, and to make the full run every trip. Loading and unloading points should be apart from street car regulation stops. Rigid examination of applicants for license, license fee in

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proportion to gross receipts, power to revoke the license for reckless driving and violation of traffic regulations, requirement that each auto bus take out from an insurance company of established reliability an indemnity bond of not less than $10,000, and that overloading should be strictly prohibited, are further measures advocated. The mayor refers to reports of Traffic Officer Butler, citing accident figures already quoted, and also to the warning of Fire Chief Eley, issued after his equipment had been delayed on the way to fires by jitney bus congestion.

Business men have petitioned the city council for a regulating ordinance, including fees of $60 a year for five-passenger cars up to $100 a year for fifteen or more capacity.

The entire situation is a new and exceedingly vital problem affecting municipal activities in several lines and public welfare, as well as the welfare of established public utilities which are heavy contributors to municipal and state revenues. The experience so far may be summed up in two principal conclusions. Operation of the jitney busses shows urgent need of careful and effective regulation, and further it has proved that automobiles cannot be operated with profit on a business basis in a general passenger transportation scheme on a flat five-cent fare, even without transfers.

[EDITOR'S NOTE.]

The above article may be supplemented by a digest of the newspaper reports from other cities showing the popularity of the jitney bus, its apparent business impossibility, and, at the same time, its success, which is probably but temporary.

Not including such attempts to establish regular routes for auto-bus lines, successful or unsuccessful, as have been noted in MUNICIPAL ENGINEERING from time to time, in New York City, where they succeeded the old Fifth avenue horse-drawn stages, Washington, Pittsburg, Indianapolis, Huntington, Ind., Los Angeles, Detroit and elsewhere, the first real jitney bus seems to have been started in Phoenix, Ariz., during a strike in 1913. It was followed in 1914 at Long Beach, a seaside resort of Los Angeles, and in October, 1914, by Los Angeles itself, as described by Mr. Reed, which city, by latest reports, has over 1,000 jitney busses in operation, taking in about $8,500 a day. The street railway company has petitioned the city council of Long Beach for permission to abandon about four miles of street car lines, which, it claims, do not pay in competition with the jitneys. The company has taken off about 40 cars from Los Angeles lines because of the reduction in traffic.

The street railways in Monterey and Pacific Grove, Cal., are reported to have been forced to the wall. Other cities followed rapidly, particularly on the Pacific Coast.

Houston, Tex., began about the middle of December and has developed over 200 cars, which have been taking $1,000 a day out of street railway fares, with an increase in number of accidents. Autos pay $1 license fee and file $100 bond to comply with city ordinances. The Jitney Association is trying to work out a regulating ordinance, in co-operation with the city council.

Seattle began a little later and now has over 500 autos in service, some of which run all night, with 10-cent fare after midnight. The Seattle Auto Transit Association has 300 members and has retained counsel to protect its interests in the Legislature. Autos pay $2 state tax and $4 city vehicle license. The State Public Service Commission recently decided that they are common carriers and subject to regulation by the commission.

San Francisco began early in January, now has over 1,000 cars in operation and expects 2,000 when the exposition traffic is developed. Regulations by city ordinance, by legislative act and by the State Railroad Commission are all in process. Oakland has 450 jitneys and an association of owners.

Fort Worth formed the Auto Transit Company about the middle of January, operating 30 cars, and individuals have

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brought the number up to 141, paying no tax or license.

Kansas City began a few days later and has more than 100 in service on 27 routes, with service on some up to midnight. There are a few motor trucks in the service crudely equipped to carry 30 to 50 passengers. There is an association which is trying to develop routes and assignments to them.

In Birmingham, Ala., the first jitneys were started by a large auto dealer to put second-hand cars in use. Others have followed. Drivers report that a second auto on a route improves the traffic by giving better service, but a third makes it hard for all three to get enough to live on a line with a limited amount of traffic.

Ogden, Utah, has the Jitney Service Company, with $25,000 capital stock, and three lines.

The first jitney bus in Peoria, Ill., started February 8 and on the 10th rather short routes were in operation along three principal street car lines, and four cars were running to East Peoria. One of the city aldermen is in the firm starting the first lines with seven cars, and will try some long lines, possibly supplying larger cars, as small autos cannot pay on long lines. The taxicab company figures a loss on 5-cent fares and will not start lines. It figures 12 cents a mile for tires and gasoline on a 3,000-pound car, chauffeur's wages, deterioration, interest, license fee, oil, repairs and liability insurance, and demonstrates its contention. The jitney bus pays the regular hack license of the city.

St. Louis has a Motor Service Company which had 11 automobiles in the jitney service February 13 and added an auto truck carrying 30 passengers on that day. The jitneys carry about 2,000 passengers a day. The service of the company is increasing daily and 25 autos are probably in use by the time this number of MUNICIPAL ENGINEERING is issued. Some of them run only in the rush hours, morning and evening. The regular lines are comparatively short, 15 to 20 minutes time being required to cover them. A 10-cent line to the Art Museum was started February 14 to run until 8 p. m. with ten cars, two of which broke down the first Sunday, and the line carried 600 passengers during the day.

Omaha is reported to have started 10 routes on February 1.

Maryville, Mo., is a small city with a single jitney bus.

Conway, Ark., has one auto bus and two 5-passenger cars on regular schedule and route.

The mayor of Portland, Ore., thru his chauffeur and 7-passenger car tested a populous route, collecting $7.75, with an expense of $4.50, not including chauffeur's wages for twelve hours.

Oak Park, Ill., started a municipal jitney bus the last week in February, running on a route over two miles long. It seats twenty passengers and costs $9.50 a day to operate, including the cost of the lease of the vehicle, so that 190 fares a day will be necessary to pay expenses.

Terre Haute, Ind., started the jitneys early in February and on the 21st had forty-two in operation on all car lines running on paved streets. Operators report satisfactory results.

Milwaukee ($10 license); Denver, Spokane, Wash., with 25; Olympia, Vancouver; Portland, Ore., with 75; Des Moines, San Antonio, Oklahoma City, Joplin and Baltimore are other cities reported to have the service. The first one in Indianapolis started early in February. Cincinnati is reported to have organized a company with $250,000 capital.

¶ GENERAL OBSERVATIONS *and conclusions are perhaps premature, but a few words may not be out of place.*

Receipts are reported to run as high as $15 a day, but the averages reported run $10 or less.

Short routes are the rule, tho the photograph of a Los Angeles jitney shows a sign indicating that its route is far from short.

In New York a year's experience with a law making auto-bus lines common carriers has convinced the Public Utilities Commission that the law subjecting them to commission regulation should be repealed. They say that "there seems to be no sound reason why any person or cor-

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poration should not use the highways under proper regulations drawn by the highways department," and that the applications for permits take their time from more important matters. The Oregon legislature has refused to put the jitney busses under the control of the State Railroad Commission, the committee stating that the cities had full power to regulate their operation.

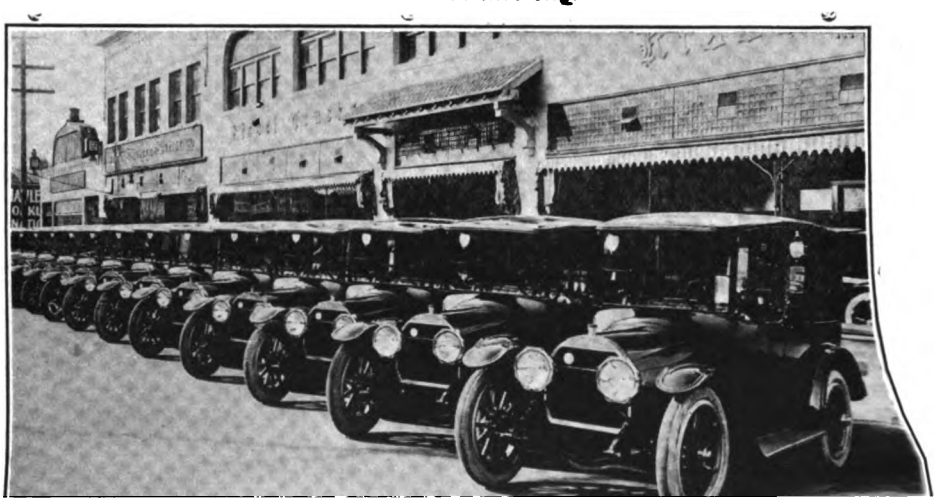
The Fifth avenue (New York) auto-bus lines are successful with 10-cent fare, largely because of the special features of the routes which attract custom and the special character of the regular traffic.

The lines in Indianapolis, intended to serve districts not well served by the street railway, failed to attract custom with a 10-cent fare, or enough to pay with a 5-cent fare, and when the fare was reduced to 25 tickets for $1, to compete with the street railway on equal terms, the receipts were reported to be sufficient for paying operating expenses, but not enough to make adequate provision for replacing worn-out vehicles.

Interurban bus lines in competition with electric railway lines are reported to be unsuccessful at Los Angeles and elsewhere. Suburban bus lines run by the Cleveland street railway where rail lines had not yet been extended were started last August, but have cost much more to operate than the receipts from them.

It seems probable, therefore, that the jitney busses will later drop out except on routes not otherwise more cheaply served. There would seem to be a field for them on such lines and in towns too small to attract a street railway. But, so long as there are cheap, second-hand cars to use up, for which there is no other use, and there is lack of employment for their owners, we are likely to have the jitney bus, regularly or sporadically, as conditions are favorable or unfavorable.

THIS PHOTOGRAPH *of a part of the fleet of Kissel limousine taxicabs purchased by the Los Angeles Transfer Company indicates that there are other systems of transportation still in operation in that city.*



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A PROPOSED STREET LIGHTING CONTRACT

By Charles A. Tripp, Consulting Engineer, Indianapolis, Ind.

The improvements in street lighting are so numerous and so great at this time that the ordinary street lighting contract, unless made for too short a time for true economy, is not able to keep pace with them. The author of this article, an expert electrical engineer who has had much experience in making and in criticizing contracts between cities and public service corporations, offers a form of contract which seems to have the necessary flexibility and to secure to the city all the benefits of the advances in electric lighting that it wants and at the same time that it provides for proper compensation to the electric light company, neither too great nor too small.

THERE has been no time since the introduction of electric lighting when the future development of lamps has been as uncertain as it is today. The past six years has seen the advent of the metallized carbon, the tantalum, the tungsten, the nitrogen and the argon lamps in the incandescent field, the latter being placed on the market during the past month, resulting in a present current consumption of about one-eighth of that required by the carbon filament lamp of six years ago. Practically the same period has seen the introduction of the metallic flame arc lamp, followed by a rapid series of improvements and modifications, which have resulted in large gains in efficiency. The future development, even two or three years hence, is certainly beyond the realm of prediction at this time.

Considering this condition, it seems to us that the time has arrived when street lighting contracts between municipalities and public service companies should take a much more flexible form, one which will give the city an opportunity to take advantage of a new type of lamp whenever it desires and yet will protect the company against loss of investment through obsolescence, to an extent that the city can obtain a reasonable rate for the service.

The following contract is based on three divisions of the payment:

First—Current used.

Second—Depreciation and interest on investment.

Third—Maintenance.

Section 1—The said company hereby agrees to deliver to the street lights suitable and necessary current for the lamps installed and the said city hereby agrees to pay the company as full compensation for said current the price of ..... cents per kilowatt hour.

The said company shall furnish and maintain on its switchboard at its plant in said city the necessary watt-hour meters for measuring this current. These meters shall be connected to the lines on the secondary side of all transformers or current regulating devices. They shall be subject to inspection or test by representatives of the city at all reasonable times.

Under this section the company receives pay for the current actually used by the city, as it would in the case of any private consumer for light or power, at an agreed price per kilowatt hour. The current used by any new type of lamp,

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or by lamps of different sizes, becomes a matter of no further concern to either party so far as their contract relations are concerned. The city pays for what it gets and the company receives pay for what it furnishes.

Section 2. The said company shall furnish and install street lights of such type or types and at such times and locations as the city may order. Upon the installation of such lamps the company shall render to the city a statement showing the cost of said lamp equipment. This cost shall include the lamp complete with the necessary fittings, hanger and lamp support, whether suspension cable, mast arm, or bracket, and the labor of installing the same, but shall not include the cost of any poles, current-carrying wires or generating equipment. The cost above referred to shall be the company's purchase price of material, plus all carriage charges and the actual amount paid for labor.

It is hereby mutually agreed that the said city shall pay the said company annually ..... per cent. of such statement, in twelve (12) equal monthly payments, for a period of ten (10) years. Such payments shall constitute a full reimbursement for all amortization, depreciation, obsolescence, interest and investment charges, and, after the expiration of the ten (10) year period, no further expense shall incur to the city for the use of said equipment.

If at any time the city desires to substitute a different type of lamp for any lamp or lamps then in use, or discontinue the use of any lamp, all of the remaining yearly installments upon such lamp equipment as is discontinued shall become due and be paid. Upon the installation of such new equipment a statement of cost shall be rendered to the city and payments on the same shall be made as above provided.

Unless a new contract is entered into between said city and said company at the time of the expiration of this contract, all of the remaining yearly installments upon the street lighting equipment shall become due and be paid, and the said equipment shall become the property of the city and may be removed by the city from the poles of the company.

This section gives the city an absolutely free hand in determining when any change shall be made in lamps, and yet protects the company fully in its investment. Whenever a lamp is developed which will produce a sufficient saving to the city in current to make it economical to abandon the old type, the city is free to make the change, without any argument as to price or modification of the existing contract.

Section 3. The said company shall take charge of the operation, maintenance and repair of all public street lights and shall render to the city a monthly bill covering the cost of all incandescent lamps used for renewals, electrodes for arc lamps, repair parts and glassware used during the previous month, plus ..... per cent. Such ..... per cent. shall be considered as reimbursement to the company for stock charges and for labor for maintenance and care of the lamps.

This section likewise is in such form that no additional agreement will be required for any change in the type, number or size of lamps. The company is responsible for the proper operation of the equipment, and receives pay for what it does. While the objection can be raised to this section that it produces a bill which it is difficult for the city to check, yet this carries small weight on account of the fact that the total item is a small one, and that most new types of lamp can be bought under a maintenance cost guarantee from the manufacturers.

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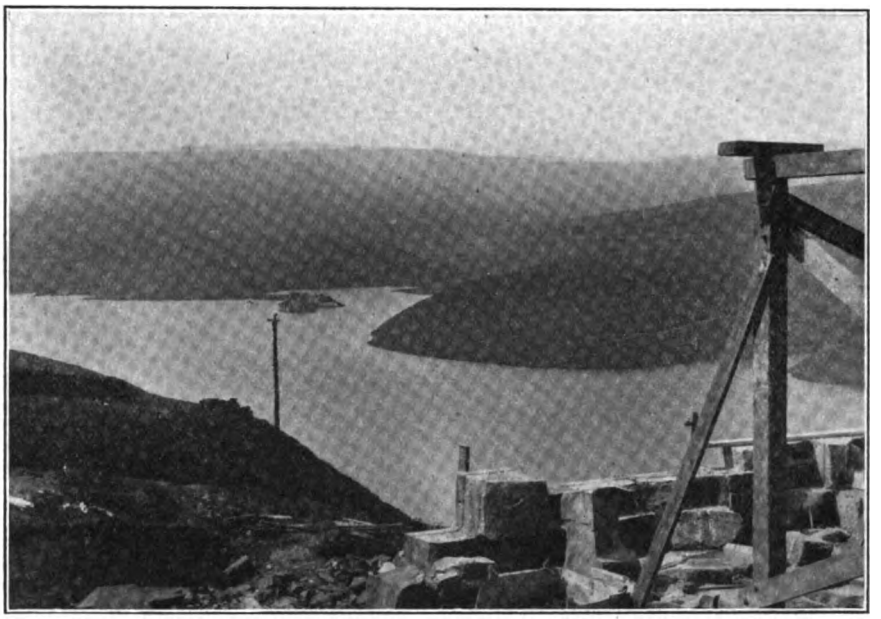

NIDD VALLEY RESERVOIR

OF BRADFORD, ENGLAND, WATER WORKS.

THE city of Bradford, in Yorkshire, England, is the center of the woolen and worsted industry in England, and the imported wool from Australia, New Zealand and other places comes into the city in its raw state and requires washing and combing, hence the city requires a good supply of water to carry on successfully the chief industry.

Besides supplying the needs for industry, the city provides water not only for itself but for twenty-five other towns outside. This demand is equal to 15,000,000 to 18,000,000 per day, in an area of over 120 square miles and a population of about half a million people.

To meet these demands the City Council had to seek powers to embark on the Nidd Valley water works scheme, which was designed by the city's water works engineer, James Watson, M. Inst. C. E. This scheme includes the Angram dam, which is situated some 32 miles away from the city. This dam is in course of construction, was commenced in 1904 and will require two or three years more to complete. The amount for this vast undertaking was about $1,400,000 (£365,495) and the amount of concreting and masonry runs to 258,700 cubic yards.

The dam forms the first of the large storage reservoirs to be constructed in the Nidd Valley for the city's supply. The outflow of water is controlled by a valve tower built on the inner face of the dam. This valve tower, which has three inlets from the reservoir, is built of masonry and lined thruout with cast iron cylinders enclosing the valves, upstand pipes, deck plates, head stocks, etc., and the valves will be worked and operated by hydraulic pressure.

By-pass or waste-water channels have been constructed on each side of the dam for convenience in carrying out the work, keeping water from the foundations, etc., and for the purpose of carying flood water past the dam.

The concrete mixers on the works can turn out some 320 cubic yards of concrete per day and there are often 500 to 700 men employed on the works. For works of this magnitude the municipal authority has provided on the site a

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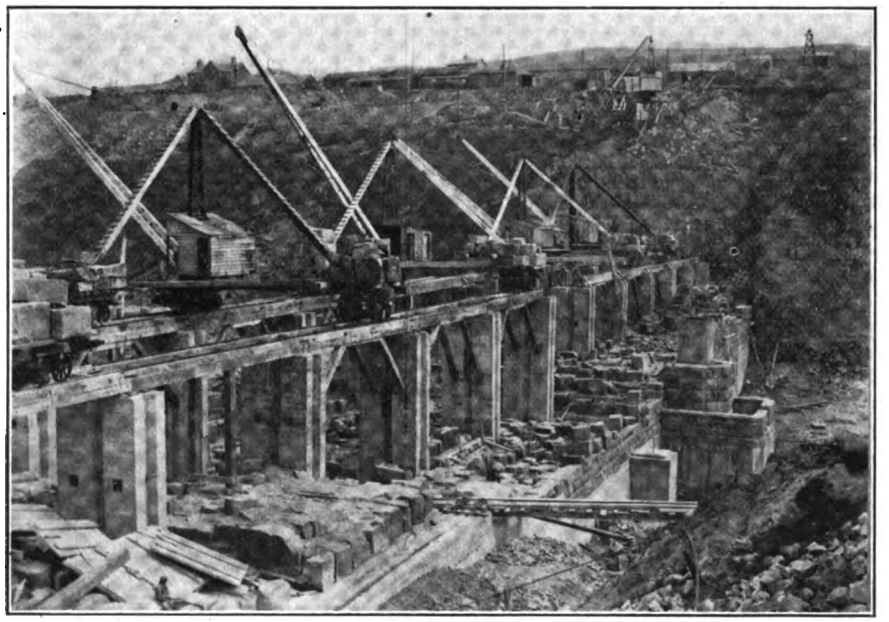
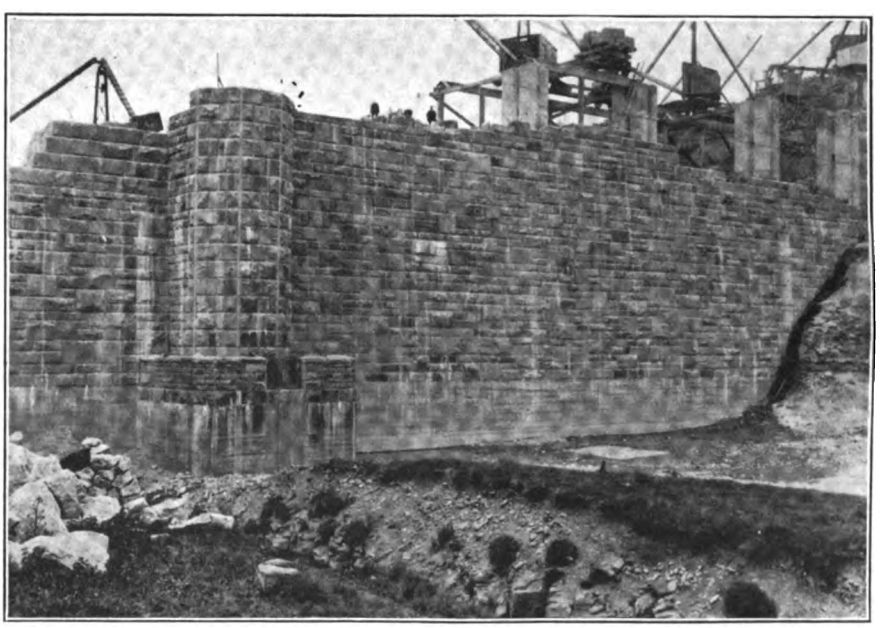


METHOD OF CONSTRUCTION *of dam. Above, concrete piers, gravity cranes and tracks, and beginning of masonry face. Below, up-stream masonry face of dam, and inlet tower.*

school for the workers' children, a reading room for the workmen, and an infirmary with resident doctor and nurse.

The corporation, in order to cope with the immense quantities of material that would be required in the process of construction, built a railway some 13 miles in length, which is the only passenger railway in Great Britain coming under the power of a city or town council.



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PUBLIC RECOGNITION OF PATENTS

By George C. Warren, Boston, Mass.

This article is the introduction to a lecture delivered by the author in the course of the Graduate School in Highway Engineering of Columbia University, and it states the principles upon which the issuing of patents is based so clearly and so fully that it is worthy of a prominent place in engineering literature on its own merits. The patent as a contract and as a monoply are discussed and legal decisions are quoted. State regulation of the use of patented articles is also fully considered.

AMONG the earliest and most world-wide and universally recognized economic governmental principles among civilized nations is one that it is to the interest of the public that, as an encouragement to "promote progress of useful arts," the inventor should, for a limited period, be given the exclusive right to use, manufacture and sell his invention and hold to himself and those who financially and otherwise assist him in its perfection and development, all profits which accrue therefrom—a legal monopoly or "patent." The principle is not only a world-wide national economic institution, but, in order that governments may secure the full benefits of the results of invention in other countries, it has become international and we have a treaty under the name "international convention," the chief feature of which is that application may be filed in any one or all of the other countries which are a party to the convention within twelve months after the filing of the first application in any convention country.

The countries which have joined in this international agreement or treaty with respect to issuance of patents are the United States, Austria, Hungary, Bosnia and Herzogovina, Belgium, Brazil, Cuba, Denmark and Faeroe Islands, Dominican Republic, France, Algeria and all French Colonies, Germany, Great Britain, Japan, Mexico, Norway, Dutch Indies, Surinam, Curacao, Portugal with the Azores and Madeira, Servia, Spain, Sweden, Switzerland, Tunis, Commonwealth of Australia, Italy, Netherlands and Guatemala.

In his "First Annual Address" to the "Fellow Citizens of the Senate and House of Representatives," dated January 8, 1790, President George Washington said:

"I cannot forbear intimating to you the expediency of giving effectual encouragement as well to the introduction of new and useful inventions from abroad as to the exertions of skill and genius in producing them at home."

From reply to this message by the Senate, dated January 11, 1790, the following is quoted:

"The introduction of new and useful inventions from abroad and the exertions of skill and genius in producing them at home * * * are objects which shall receive such early attention as their importance requires."

Sixty-four years later, President Franklin Pierce, realizing that the patent franchise, as it had at that time developed, was too narrow and did not offer sufficient encouragement to invention, in his message to Congress dated December 5, 1853, used these words:

"I commend to your favorable consideration the men of genius of our country, who, by their inventions and discoveries

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in science and arts, have contributed largely to the improvement of the age without, in many instances, securing anything like an adequate reward. For many interesting details upon this subject I refer you to the appropriate reports and especially urge upon your early attention the apparently slight, but really important, modification of existing laws therein suggested."

It is certain that any individual, municipality or other community that refuses to use or purchase a patented article is seventeen years behind the times, for practically every invention of merit is patented and the patent does not expire for that period.

It is equally certain that any individual or community which undertakes to undermine a patent, after the patentee and his associates, by expenditure of large measures of brain, money and energy, have developed a market for his useful invention, is practicing a most unfair attitude not only toward the inventor, but toward the government which has adopted the patent system as an economic institution for the purpose of fostering and encouraging invention, which is essential to progress.

A community which does not invent is one which is centuries behind the times, and a country which does not foster inventions by patent franchise is a country in which there is little progress in industry, art or science from century to century.

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¶ THE PATENT FRANCHISE *is a contract of the government with the inventor for the benefit of the people as well as of the patentee.*

The patent franchise is not by any means a present from the government to the inventor, but is a carefully planned contract which in the United States has its foundation in the Federal constitution on which our government is based, an agreement between the government and the inventor with consideration on each side under which:

1. The inventor undertakes to:

(a) Perfect to a practical result an idea which it would not be worth expenditure of his time, energy and money to develop if the public was to have all the resulting benefits.

(b) To fully and publicly describe his invention so that, at the expiration of the patent, he will have dedicated to the public such full information regarding the invention, without trade secret reservations, as will enable one skilled in the art to prosecute the invention.

2. In consideration of the foregoing the government grants to the inventor the exclusive right to prosecute his invention for a limited term of years, which varies in different countries. In the United States the term was formerly fourteen years with a privilege of renewal for seven years more, making a total patent franchise term of twenty-one years. This was changed in 1861 to a flat term of seventeen years from the date of issue of the patent, with no right of renewal.

Here we have an evenly balanced, well considered contract, with clear-cut, definite and valuable consideration from each party to the other—the government representing the interests of the public on the one hand and the inventor on the other.

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¶ A PATENT *is not a true monopoly, tho it gives to its owner a certain control of the sale and use of the invention for a limited time.*

A patent is not a monopoly in that objectionable sense in which the term is generally used. Decisions of the highest court of our country tell us that it is such a monopoly as was expressly authorized by the constitution of the United States, and that Congress has enacted laws to promote improvements in the arts and sciences by securing to inventors for a limited term a monopoly of the right to make, use and vend their inventions. It has been universally conceded that these laws are highly beneficial. Years before the adoption of the constitution, the English Parliament, in the reign of King James, enacted a statute (21 Jac., Ch. 3) giving inventors exclusive rights for fourteen years.

The following citations from decisions of the Supreme Court of the United States

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and quotations from standard text-books should uproot any impression that there is anything injurious to the public in the limited monopoly granted to inventors.

Extracts from United States Supreme Court Decisions.

"It is undeniably true, that the limited and temporary monopoly granted to inventors was never designed for their exclusive profit or advantage; the benefit of the public or community at large was another and doubtless the primary object in granting and securing that monopoly. This was at once the equivalent given by the public for benefits bestowed by the genius and meditations and skill of individuals, and the incentive to further efforts for the same important objects." *Kendall v. Winsor*, 21 How., 327.

"Letters Patent are not to be regarded as monopolies, created by the executive authority at the expense and to the prejudice of all the community except the persons therein named as patentees, but as public franchises granted to the inventors of new and useful improvements for the purpose of securing to them, as such inventors, for the limited term therein mentioned, the exclusive right and liberty to make and use and vend to others to be used their own inventions, as tending to promote the progress of science and the useful arts, and as matter of compensation to the inventors for their labor, toil and expense in making the inventions, and reducing the same to practice for the public benefit as contemplated by the constitution and sanctioned by the laws of Congress." *Seymour v. Osborne*, 11 Wall, 533.

In *Allen v. Hunter*, 6 McLean, 306, the Court, denying that patents are monopolies, said:

"The right of the patentee entirely rests on his invention or discovery of that which is useful and which was not known before. And the law gives him the exclusive use of the thing invented or discovered for a few years as a compensation for his 'ingenuity, labor and expense in producing it.' This, then, in no sense partakes of the character of a monopoly."

In *ex parte Robinson*, 4 Fisher, 186, Judge Davis said:

"The property in inventions exists by virtue of the laws of Congress, and no state has a right to interfere with its enjoyment, or to annex conditions to the grant. If the patentee complies with the law of Congress on the subject, he has the right to go into open market anywhere within the United States and sell his property."

¶ STATES CAN REGULATE *use of patented articles, but cannot prohibit such use simply because they are patented.*

It is true the several states, in the exercise of their police power for the protection of the public health, safety and morals, have the right to regulate, within reasonable limits, the use of a patented article within their borders, if either of the above interests should be affected by its use, but no state has the right, directly or indirectly, to prohibit the use of any patented article simply because it is patented, unless its use can be construed to injure the public health, safety or morals.

Judge Brawley, a distinguished judge of the United States Circuit Court of Appeals, has said of patents:

"The protection and hope of profit, held out by our patent laws, inspires that stimulating energy which leads to experiment, invention and all the resulting benefits." *Crown Cork Co. v. Aluminum Co.*, 108 Fed. R., 870 (1901).

These opinions of the highest courts of the country suffice to show the favor with which the law regards patent rights. Is it believed to be right that an inventor should be persuaded to forego the rewards which a just and beneficent law of Congress has bestowed upon him in recompense for his years of toil?

In the case of *Kendall v. Winsor*, cited above, the Supreme Court said:

"But whilst inventors are bound to diligence and fairness in their dealings with the public, with reference to their discoveries, on the other hand they are by obligations equally strong entitled to protection against frauds or wrongs practiced to pirate from them the results of thought and labor, in which nearly a lifetime may have been exhausted; the fruits

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of more than viginti annorum lucubrationes, which fruits are ultimately to gather."

It is no just criticism of either the principle of or results from the patent franchise to say that a very large percentage—certainly much more than half—of the patented inventions have so little practicable merit that little is heard from them after the patent is issued and that a smaller percentage fail after practical trial and the expenditure of a large amount of brain, energy and capital in development of the invention.

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¶ THE TELEPHONE, *the electric light, the wireless telegraph, have required years of time and millions of money to develop them, which could not have been expended if those making the improvements, as well as the original inventions, had not been protected during the lean years before they could be shown to be practical essentials in everyday life.*

Does any one suppose that either Prof. Bell, in the case of the telephone, or Dr. Edison, in the case of the electric light, and the hundreds of others operating with them in reducing their ideas to practical results, would or could have expended the years of patient effort and millions of money necessary to accomplish their magnificent results, if they had not seen ahead a compensating encouragement and reimbursement for their investments in time or money, which compensation was only possible through the granting and operation of the patent franchise?

It is well known that even with the encouragement offered by the patents, both the Edison and Bell companies passed through years of anxiety and nearly through bankruptcy before their inventions were a practical success, and the same may be said of nearly every invention which is sufficiently novel and sufficiently universal in its application to become a real factor in the world's progress. Calmly ask yourselves the questions: "Is the world indebted to Bell and Edison, or are they indebted to the world? What does it matter if they and their associates ultimately made millions before their patents had expired when, on the other side of the balance sheet, we see that we can converse between New York and Chicago as clearly as we can converse in this room, and that the clearest and most economical light is produced by chaining natural water power, converting it into electric current and transmitting the current often hundreds of miles, into our homes, offices and streets?" On the evening of January 25th it was demonstrated that conversation can be clearly carried on by telephone from Boston to San Francisco, over more than 3,200 miles of wire, and not only the words clearly understood but the voice recognized.

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¶ THE DEVELOPMENT *of the great inventions to their present practical values has been possible because of the patent system and its protection of the enormous investments necessary to make these developments and put them into use.*

On a recent visit to Arizona I was impressed with the magnitude of the hydro-electric power, heat and light development for which Dr. Edison is chiefly responsible. A few years ago that state was an arid desert. No vegetation—wood, coal nor oil. From the Roosevelt dam, developed by the government, in the northern part of the state, abundant water for irrigation is carried hundreds of miles, converting the desert into one of the most productive and diversified agricultural communities which any country of the world has ever produced. Coincident with this, from the same dam, power and electricity are developed which, thanks to the patented inventions of Edison and others, is carried hundreds of miles and supplies the universal heat and light required by the community at a fraction of the cost of any other heat and light because of the absolute absence, in that state, of the elements necessary to provide other forms of heat and light—coal, oil and wood.

I care not how many millions Edison and his associates may have made out of their patent franchises, the public in the single state of Arizona is making many times that amount by reason of those franchises. Another incident in Phoenix, Ariz.,: I wrote a telegram and was asked

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by the hotel clerk if I wanted it sent by wire or wireless telegraph. Actually, Marconi is competing with the Western Union and Postal Telegraph companies in that state which, ten years ago, was a desert. Will any one claim that that development would have been a possibility if Marconi had not been granted patents covering his inventions? And so down the scale you may trace any and every successful patented invention add you will find the patentee has given more than he has received and, almost as universally, the invention would never have been perfected and developed if the encouragement of the patent franchise had not been granted by the government.

I have specially dwelt on the foregoing phase of the patent franchise because a considerable, and, I fear, a growing part of the community looks upon the patent as a sort of monopolistic graft which should not have been granted and which any one has a moral right to appropriate.

With equal certainty of not being caught, people who would not steal a horse will, without compunction, steal a patent although the investment of the owner is much greater in the patent than in the horse. Morally, one of the forms of theft is the same as the other. Legally, in the case of the horse, the thief goes to jail if caught, but, in the case of the patent, the law in effect says to the owner:

"You may litigate and in the end you will get recovery in damages, provided your pocketbook is long enough to stand the onslaught which your pilfering competitor wages on you."

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¶ THE COMMON CLAIM *that a simple and common idea has been patented when it deserved no such protection is disposed of by the courts, as in an English case here quoted.*

In an unusually important and interesting English patent infringement case, the *Edison Bell Phonograph Corporation Limited vs. Smith & Young* (Reports of Patent Cases, London, Volume 11, page 398), the Court of Appeals of Great Britain in discussing the impropriety of certain highly technical, tho common efforts of endeavoring to defeat patented inventions, which by practical development have proved to be of merit and general public utility, used the following forceful language:

"Whenever I hear the objection taken to a patent which has been used, which has been bought and sold, which has been therefore treated by men of business as a useful thing, that it is wanting in subject-matter, I look upon it, I confess, with an amused contempt.

"What is the meaning of want of subject-matter. It is not the same thing as want of invention, or rather I should say as want of novelty; it is not the same thing as want of utility, but, where you cannot maintain either of those propositions which would be sufficient to destroy the patent, it is something else, which some one or other, at some time, has invented as an idea for destroying patents. And what is it? It really comes to this, that, although the invention is new—that is, that nobody has thought of it before—and altho it is useful, yet, when you consider it, you come to the conclusion that it is so easy, so palpable, that everybody who thought for a moment would come to the same conclusion; or, in more homely language, hardly judicial, but rather businesslike, it comes to this, it is so easy that any fool could do it. Well, I look, as I say, upon that objection, when all others have failed, generally with amused contempt. It can be made, out, but hardly ever. When you find that which I have stated, it is hard to think that people would be buying and selling a thing—and that has been sometimes the whole thing—and yet the objection should be taken that it is wanting in subject-matter."

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¶ SUCCESS *where others have failed is often given in court decisions as evidence of patentability.*

Touching on the trend of the court cases where the patentee has produced a successful result where others, working along somewhat similar lines, had failed to accomplish that result, where, in other words, there is sufficiently close relation between the "prior publication" or other "disclosure" and the successful patented

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result but producing the all-important difference between "failure and success" respectively, but sufficiently close relation to provide means for ingenious attorneys to wage a contest against the patent, the following extracts from important decisions are interesting:

"Inventors are not precluded by the embryonic and shapeless ideas found in former patents, any more than they are by such undeveloped matter existing elsewhere." (124 F., 486, *Canda vs. Michigan*).

"Courts incline to sustain a patent to the man who takes the final step in the invention which turns failure into success" (*The Barbed Wire Patent*, 143 U. S., 275).

"The great commercial success of a patented device may turn the scale on the question of invention in a doubtful case" (*Beckwith vs. Malleable Iron Range Co.*, 174 F., 1001).

"The widespread commercial success of a patented device should be taken into consideration in determining the question of invention" (*Coffield Motor Washer Co. vs. Howe et al.*, 190 F., 42).

"The fact that as soon as a patented improvement was made and introduced, its advantages over devices which had preceded it became manifest at once, and it commended itself to the public as a practical and desirable improvement, affords a safer criterion of inventive novelty than any subsequent opinion of an expert or intuition of a judge" (*Palmer vs. Johnston*, 34 F., 326).

In *Expanded Metal Co. et al. vs. Bradford et al., etc.*, U. S. Sup. Ct. 143 O. G., 863, Mr. Justice Day says:

"It is often difficult to determine whether a given improvement is a mere mechanical advance or the result of the exercise of the creative faculty amounting to a meritorious invention. The fact that the invention seems simple after it is made does not determine the question; if this were the rule, many of the most beneficial patents would be stricken down. It may be safely said that if those skilled in the mechanical arts are working in a given field and have failed after repeated efforts to discover a certain new and useful improvement, he who first makes the discovery has done more than make the obvious improvement which would suggest itself to a mechanic skilled in the art, and is entitled to a protection as an inventor. There is nothing in the prior art that suggests the combined operation of the Golding patent in suit. It is perfectly well settled that a new combination of elements, old in themselves, but which produce a new and useful result, entitles the inventor to the protection of a patent" (*Loom Company vs. Higgins*, 105 U. S., 580-591).

"If our purpose was speculative, not practical, we might pause to wonder how such substances could produce such results under the conditions to which they are subjected, and by wondering we express in a way the quality of the invention. * * * We need not, however, dwell longer on the excellence of the invention. The government has testified to its excellence by using it in the guns intended for the national defense" (*United States vs Societe Anonyme des Amiens Etablissements Cail*, 178 O. G., 591).

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TRAFFIC CONTROL

AT ELECTRIC RAILWAY CROSSINGS.

The electric railway can use the current from its own wires to operate audible and visible signals so that its problem of protection of crossings of its line with highways, steam railroads and tracks of its own or other electric railways is comparatively simple. In this article are described a signal system for a street railroad crossing on a busy city corner and automatic signal systems for highway crossings of interurban roads which have the advantage over ordinary railroad crossing signals of being visible as well as audible by night or day, and of showing to the motorman whether it is in operation.

RAILWAYS operated by electricity can use the electric current in operating signals at crossings with other railroads or at highway crossings so that they will not be subject to the breaks in service liable in battery systems. They can be either audible or visible or both and can be made automatic if desired.

The first of the accompanying illustrations shows a novel and practical street-traffic control system as installed at the intersection of Euclid avenue and East 105th street, on the Cleveland 3-cent-fare street railway system.

Electric lights are placed on the right-hand side of each street so as to face oncoming vehicles. A red light denotes stop and a green light proceed. The red light is placed on the near corner of the crossing and the green on the farther corner. The officer who controls the switch is stationed in a booth to the left in the accompanying illustration. The sides of the booth are glass and this enables the officer to see traffic in all directions. The switch is so interlocked that it is impossible to give conflicting signals.

When traffic is opened in one direction it is automatically closed in the other direction. When an alarm is turned in at fire headquarters an instrument in the booth notifies the officer so that he may clear the crossing for the passage of the fire apparatus. After throwing an emergency switch which sounds an alarm bell and flashes red lights at all crossings, he is free to leave the booth and give his attention to the street.

The photograph is self-explanatory, tho a little study may be necessary to distinguish between the lights showing up and down Euclid avenue and those showing to 105th street.

A highway crossing protection has been installed on the Washington-Virginia Railway Company lines, with trolley-contact control adapted to the operating conditions. One of these has been in successful operation for a long period on a single track ,and two others on double tracks have recently been installed.

At Clark station, on the Falls Church division, which is double track, the headway is 30 minutes during the day and 15 minutes in the evenings. Trains are run in sections, as many as four or five following each other closely. The highway crosses at right angles and at a considerable grade, but the view of the railway from the highway is obscured by trees, brush and a high bank on three of the corners.

The apparatus installed at this crossing consists of an iron pole having the sign, bell and relay attached to it, and the control box a part of it. The starting contacts, operated by the trolley wheels, are

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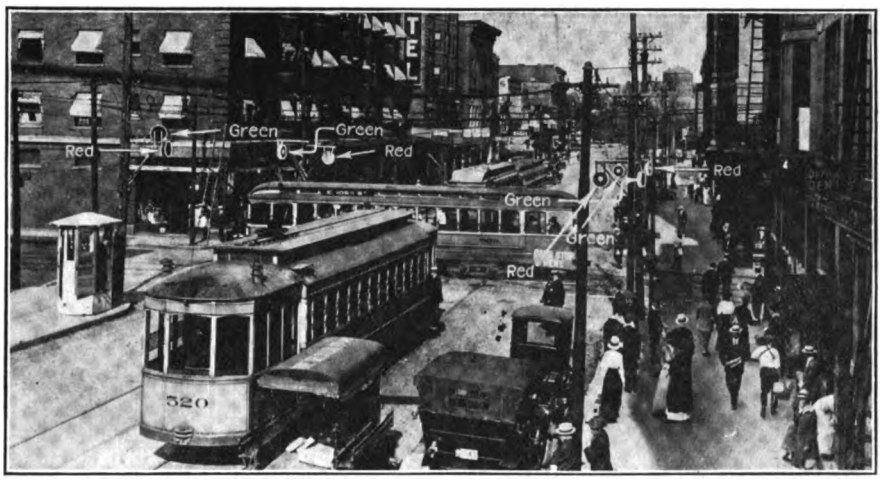

SEMAPHORE STREET CAR SIGNALS *at crossing in Cleveland, O. Starter's box at left. Note carefully red signals on near sides of crossings for stop signs, green signals on far sides for safety signs. Both cannot show at once. Lights by night and discs by day.*

placed about eight poles from the highway in each direction on the corresponding track, and the stopping contact is at the highway, there being four contacts in all. Flashing pilot lights are located three poles ahead of each contact to indicate the bell operation to the motorman. The control circuit, bell and lights are all tapped from the trolley, and no other source of power is used. The speed reaches a maximum of about thirty miles per hour under the contacts, the bell ringing twenty to twenty-five seconds before the car reaches the crossing. The warning indication is given by a 12-inch bell and a transparency flashing the word "Danger," one of the series of lights in this transparency being run each way to the indicator.

As the car passes the starting contact and is approaching the crossing, the action of the bell is shown to the motorman by the flashing light in the indicator. The use of a flashing light as a return indication of the actual ringing of the bell has been favorably received by the railways, as it overcomes an objection to crossing signals that the motorman must proceed assuming the bell is ringing.

There are six 23-watt 110-volt mazda lamps, shunted by resistances, so that the failure of one lamp does not affect the operation of the remainder. The flashing of the lights is produced by a contact maker on the armature of the bell clapper. On account of cars following closely over the crossing, a type of bell was chosen having a car-counting control such that the bell will not be cut out at the stopping contact until all the cars that have passed the starting contact have also passed the stopping contact.

The sign consists of a neat cast iron danger transparency with red lights within, accessible by opening latched doors at the side, the letters in the transparency being six inches high. The words "Railroad Crossing" in raised letters are arranged in a circle around it. The bell and relay unit hang on the pole below, the hammer striking the bell thru an opening from within, making a weatherproof construction. The relay unit comprises a pair of counting magnets, operating a revolving switch in the manner of a drum controller, and the bell magnet, which breaks its own circuit. The contacts are oil break, the oil tank covering the entire relay.

Below the bell, about the height of a man, is the fuse and control box, from which all bell circuits may be tested out, disconnected or fused, and the bell started and stopped manually. The wires enter the standard in a cable suspended from a messenger wire as is usual on

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CROSSING SIGNAL *at Hume, Va., operated by cars on either track. The word "Danger" is lighted and the bell is rung by car approaching on its proper track.*

switch indicators. The entire standard is mounted on a concrete pedestal by foundation bolts.

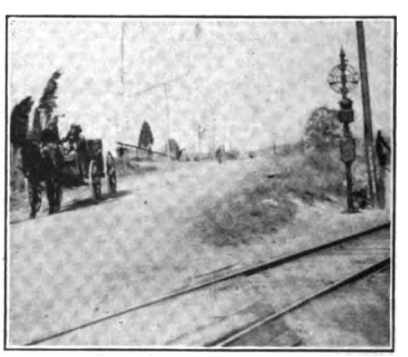
There is a similar signal at the double-track crossing at Hume, on the Alexandria division. There is a good view of the tracks both ways from the highway, which crosses at 45 degrees. This is an important and busy thorofare. Cars pass every 20 minutes during the day and every 10 minutes during rush hours morning and evening. Cars are run singly and with trailers having no trolley.

At Military road, near Rosslyn, Va., on the Falls Church division, there is a single-track crossing signal installed on a main highway leading to Fort Myers, where maneuvers are held, and funerals and tourists' sight-seeing cars pass frequently. Trolley cars follow each other closely at certain times of the day, passing every quarter hour. The starting contacts in this installation are about nine spans away from the highway, three contacts being used. The control of this type of bell is both car-counting and directional.

The frequency of cars at this point amounts to the bell ringing about one hour in the twenty-four hours. The bell and relay unit with bracket is mounted on an existing pole and a separate danger transparency is hung by a bracket on the same pole. This is somewhat novel and consists of a sheet-iron sign with letters twelve inches high, composed of small lens-like glasses, with many facets, the letters themselves being white on a black background. The subdivision of the glass into a multiplicity of small units is a protection against malicious breakage, and, like the military mast on warships, would require many blows to demolish it.

The photograph above shows the crossing at Hume with the door of the control box open, while in that below the environments of the crossing may be seen. To the right and above the signal the trolley contact may be seen. This has no moving parts.

VIEW OF ROAD *at the Hume crossing shown above. The signal is visible for a considerable distance in either direction, and the road makes a sharp angle with the tracks.*



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SEWAGE DISPOSAL WITHOUT ODOR

By Rudolph Hering, Consulting Engineer, New York City.

This article is that part of a paper before the American Association for the Advancement of Science at its Philadelphia meeting, which is devoted particularly to the methods for treating the collected sewage and rendering it innocuous, and considers them specially with reference to making the processes inodorous, at least to the extent that they shall not become offensive to surrounding inhabitants of the district. The author is fitted to speak with authority, having done as much as any one to introduce inodorous methods of sewage disposal.

ALL processes of sewage treatment and disposal, if they are to be satisfactory, permanent and economical, should require a separation from each other of the floating matter, of the settling matter and of the liquids.

As these three parts of the sewage are materially different substances, one being solid and light, one solid and heavy and one liquid, the methods of economical treatment in order to make them inoffensive will also be different in nearly every case, and therefore a separation is generally to be recommended. It is not always made, and at some places it may not yet be of sufficient importance to justify the additional expenditure. The drift of opinion, however, is clearly in the direction of separation and we should endeavor to design our works accordingly.

The floating matter can be retained with little trouble and expense, either by screens or as scum in settling tanks. Being often offensive, the best disposition is usually by fire or by burial. Numerous screen designs are now in use, but there is practically no preference so far as the prevention of odors is concerned.

The settling matter which forms the so-called sludge is that part of the sewage which has always given the greatest amount of trouble, has constituted the greatest nuisance, and until very recently has successfully defied a treatment which would make disposal inoffensive.

The bulk of the sludge does not decompose by oxidation. Its exposure to the air allows but a thin film to oxidize at the surface, but the exposure permits it to take up many species of bacteria, some of which cause offensive putrefaction. Many ways and means have been tried for the last fifty years, both in England and Germany, to get inoffensive sludge decomposition. A solution has at last been found in an expedient which allows the sludge to decompose under water, with the practical exclusion of fresh sewage and air.

The first step towards getting this result was taken by Dr. W. O. Travis, of Hampton, England, who devised a two-story tank, the upper division serving as a settling tank, with a slot at the lower edge of an inclined bottom, thru which the settling suspended matter passed into the lower division to accumulate and decompose. The in and outflows of the two tanks were so proportioned that from three-fifths to four-fifths of the sewage passed thru the upper division and one-fifth to two-fifths thru the lower one. So far as an inoffensive sludge decomposition is concerned, this Hampton tank is not a success.

The same two-story tank was later built in the Emscher district of Germany by

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Dr. Ing. K. Imhoff, with at least one important change. No sewage whatever was allowed to pass thru the lower tank, causing a practical exclusion of any part of the sludge from a continuous contact with fresh sewage and air. Other advantageous changes were suggested.

The decomposition of the sludge takes place in the lower division of the tank in the absence of dissolved oxygen in the sludge, but the novel condition is that it continues in the absence also of sulphur bacteria producing sulphureted hydrogen, and in the presence of bacteria producing substantially only methane and carbon dioxide gases, neither of which has an offensive odor. The conditions in the tank gradually become adjusted to conditions favoring the life of substantially only those two classes of bacteria and causing practically all of the others to perish.

¶ AN EXPERT REPORT *shows the inoffensive character of sludge treatment in absence of light, air and fresh sewage.*

The Royal Institute for Water Hygiene in Berlin, through Prof. Dr. K. Thumm and Prof. Dr. C. Reichle, has recently issued a report on the results of a thoro investigation of this new method of inoffensive sludge treatment, from which substantially the following conclusions are extracted:

The process of decomposition of sludge is found to differ sometimes quite materially according to the character of the sewage. The same arrangements and designs will, therefore, not suit all of the conditions nor all localities. The topographical conditions, especially as to available areas and elevations, make different designs a necessity for economical reasons. They will determine whether the sludge decomposing chamber should be located below (Emscher tank) or beside the settling tank. In all cases a sharp distinction must be made between a simple settling of the suspended matter and the decomposition of the sludge.

During the process of ripening the sludge of the Emscher tank has a grayish color. When ripe it is deep black, has a peculiar tar-like though not disagreeable odor, and easily allows its water to drain away in a fairly clear, colorless condition and without a putrid odor. The sludge reacts alkaline. When left too long in the sludge chamber and when it has become over-ripe, it again changes to a grayish color and has an offensive odor, it does not easily drain its water and has a distinct acid reaction. In order to decompose quickly and satisfactorily sludge should not be acid. If found to be so, it is generally due to an excessive vegetable diet. It should then be brought into intimate contact with a sufficient amount of slightly acid-neutralizing bodies, among which the most common are fresh sewage and hard water.

¶ ALKALINE SLUDGE *is essential and can be secured and maintained by several methods here clearly stated.*

The Berlin Experiment Station has pointed out the great desirability of having a proper mixture of sludge and sewage in order to secure a good alkaline sludge. It is, therefore, advised for this purpose to install a mechanical agitator in the tank, to be used daily for effecting a thoro mixture. The results of this agitation were always found to be good. The introduction at the bottom of compressed air escaping and rising thru the sludge was also found to be effective, tho less so than mechanical agitation.

It was also found essential to withdraw the decomposed sludge regularly, frequently and in small amounts. If not so withdrawn and at the proper time, it is apt to become acid and dead.

It, sometimes occurs that on the surface of the tank there is an undue frothing and excessive scum formation. After due consideration and experiment it was found that these objectionable conditions could be removed by draining off the sewage in the sludge chamber and refilling the same with clean water from the municipal supply, especially if it had considerable temporary hardness. In some cases a good sludge can be produced only by the addition of slight quantities of

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alkalies, as lime or soda, to the sewage.

The Berlin Experiment Station gave a careful study to the scum and frothing in the settling tank and in the chimneys connected with the sludge chamber, other important conclusions being as follows:

❡

¶ FROTHING *and consequent overflow of the frothing material is troublesome, but can be prevented by the methods described.*

It is not advocated as a permanent measure to reduce the scum cover in thickness by merely an occasional stirring with poles or by breaking it up with a stream of water. It is preferred to use a permanent mechanical apparatus or agitator which not only stirs the scum but brings about a thoro mixture of it with the sewage, subsequently allowing the necessary time for sedimentation. Frothing is found to be due mostly to large amounts of gas rising to the surface from the sludge chamber and carrying up finely divided sludge with the bubbles. Agitation usually prevents this trouble. When the sludge in the lower chamber is ripe, the scum formation in the upper chamber is light.

When there is great activity in the decomposition, sludge particles rise thru the slot into the upper chamber in spite of the usual overlapping of one side of the slot, intended to prevent such rising. Sufficient room should be provided for accommodating the floating sludge in order to prevent operating difficulties.

❡

¶ SLUDGE TANKS *may be placed below or alongside the sewage settling tanks, with the advantages and disadvantages here stated.*

Studies were made of the effects of the relative advantages of two groups of tanks, one having the sludge chamber below and the other beside the settling chamber.

The first group has the great advantage of an automatic sludge separation. It has the disadvantage frequently of increased expense due to the greater depth of excavation. This greater depth has in itself the advantage of placing the gases of decomposition in the lower tank under increased pressure, which causes the sludge to expand, become more porous and more readily drained when it is withdrawn and discharged on the surface of the ground. Another disadvantage of the first group is the necessity of giving a very close attention to the sludge removal, and to get the right proportion of capacity between the upper and lower chambers. Unless the proportion of sludge to the superimposed liquid approximately corresponds to the character of the sewage and sludge, the results may not be satisfactory in finally turning out economically an inoffensive sludge. Expert supervision is required, particularly during the period of ripening.

The second group has the disadvantage of pumping or of conveying the sludge from the settling to the sludge decomposing tank. It has also the disadvantage of producing less easily drainable sludge, due to the shallowness of the tanks. It has the advantage of a complete separation of the two tanks, so that the sludge decomposing tank can never thru irregularities have a detrimental influence on the settling tank. Extensions can also be more easily made to the tanks and they can be more readily inspected.

The separate sludge decomposing tanks can be built as single units which are intermittently filled, or they can be built as a series of tanks continuously operated.

❡

¶ THE OBJECTIONS *to the dilution method of sewage disposal are often due to improper application of the process, which is, after all, the natural process.*

The City of Baltimore has installed separate sludge decomposition tanks and the experience there gained will be valuable. The City of Brookline is conducting some experiments with a similar device of using tanks beside each other and also one over the other. The decomposed sludge is found to be equally good in both cases. The preference between the two methods may usually be decided by the

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relative economy and facilities for construction and operation.

Considering now the last part of the sewage to be disposed of, namely, the liquid, we find that the commonest, because cheapest, way of disposal is to turn it into running water. This process is called the dilution method.

There has been much popular objection to such a disposal, partly due to cases that have caused much offense and partly due to sentiment. Neither reason is valid against the method if it is properly applied.

Most of the objectionable organic waste matter on the surface of the earth is by nature discharged into and purified by either air or water. Our exhalations and all gaseous waste products are purified by a preliminary dilution in the air. All the rain water flowing over the surface of the earth, the accumulated wastes of animal and vegetable life, are washed into rivers and then into the ocean. Some rivers purify such waste matters within a few miles of flow. Some cannot purify at all water loaded with suspended mineral matter. As soon, however, as the ocean or a large lake is reached, all objectionable waters are completely purified.

The dilution method is quite efficient for sewage disposal and is in every way satisfactory, provided we recognize the principles on which it can be carried out. There is a certain varying amount of oxygen dissolved in all running fresh and salt water, which is taken up from the overlying atmosphere in accordance with well established physical laws. On the other hand, there is a certain varying amount of oxygen required by the different parts of the organic matter of sewage which is necessary to oxidize it. Therefore, generally speaking, we have the question as to how much of this oxidizable organic matter can be decomposed by the available dissolved oxygen in the water.

A large number of chemical, biological and physical examinations have been made to determine the elements of this problem. A large number also of actual cases of sewage disposal by dilution for American and European cities have given practical demonstrations of the advantages and limits of this method of disposal. The conclusions which may now be drawn from all the evidence are quite satisfactory.

¶ THE REQUIREMENTS *of safe discharge of sewage into running water are simple and are briefly stated.*

In order to discharge sewage safely into running water so as not to create nuisance, we should first deprive it so far as practicable of all floating matter which would deface the surface of the stream, and of all heavier matter which would settle and deposit on the bed of the stream. The remaining liquids should be discharged so far below the surface as practicable and dispersed into and distributed thru a body of flowing water which is great enough to contain the necessary oxygen required to oxidize the organic matter coming in contact with it. A sufficient dilution causes an immediate cessation of all nuisance, if one existed, or prevents its occurrence, if the above simple conditions are maintained. By following such a practice no offense to sight or smell can ever arise.

Another method of oxidizing the liquid sewage is to expose it in such a way that atmospheric oxygen will cause the oxidation of the dissolved organic matter. This is done by the well-known methods of so-called filtration.

The liquids are made to pass through a bed of sand or broken stone, so that the surfaces of the grains become wetted by the percolating sewage. The surfaces in a ripe filter are covered with a gelatinous film, supporting myriads of bacteria which decompose the dissolved organic matter contained in the liquid percolating thru the film. The decomposition takes place in the presence at the film of a sufficient quantity of oxygen containing air and of a suitable temperature for the best bacterial activity. There is a definite relation between these factors, and it will be possible, eventually, to arrange them so that the greatest bacterial activity can be determined at the least cost for each given case. This branch of the

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science of sewage purification yet needs some further development to determine in all cases the best proportions.

¶ THE PRINCIPLES *of action of various filtering materials differ and the methods used must conform to these principles.*

If sand is used, the liquids may be turned upon the top of the filter bed, from which they will percolate and wet the surfaces of all the grains and isue in an oxidized condition at the bottom drains. If broken stone is used, the liquids must be sprinkled over the surface of the beds or left in contact with the entire body for a sufficiently long time, generally by repeated applications, to get the same effect.

The recent advances made in oxidizing liquid sewage have not been great. A large field is still open for investigation, in order to obtain the greatest possible efficiency with the least cost under the usually variable conditions of practice.

Having now, as regards sewage disposal, covered the subject of nuisance, it remains, in closing, to mention the removal of dangers to health relating to such disposal. These dangers lie in the transportation to other points of pathogenic bacteria contained in the fresh sewage from sick persons and in the subsequent possibility of their once more getting into the bodies of human beings and higher animals.

Bacteria not only adhere to particles of solid matter, but remain in any liquid carrying them. It is possible that solid particles of sewage may be stranded in sewers, be held back and finally be blown away by an air current, enter the atmosphere and thus, by contact, cause a new infection. It is also possible that liquids may splash and throw bacteria into the air. In both cases the danger of transmitting disease is extremely small, if the sewers have smooth interior surfaces, no opportunities for eddies to form, and good grades to cause a rapid velocity from the sewage receptacles to the outfall, conditions which have been advocated for many years.

¶ HOW TO PREVENT *the dissemination of dangerous bacteria before they are destroyed by the purification processes used is an important problem.*

If the sewage is discharged into a sufficiently large diluting current of water, the pathogenic bacteria are gradually starved and perish. If the sewage is treated on land, there is some slight risk of transfer by violent winds. Generally the bacteria are either retained in and carried away by effluent water or are held back on the grains of the filter. In the latter case they eventually perish by exposure in the unfavorable environment, and in the former they can be at once destroyed by an inexpensive chlorine treatment such as is now for the same purpose given to most of our surface water supplies.

From what has been said above I believe that we have at last reached a stage of development in this branch of sanitary engineering, which enables us efficiently and economically to collect sewage at its sources, carry it to the outfalls and there dispose of it either in water or on land without causing offense at any point along its course and reduce to a minimum all danger to health.

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A NEW BUILDING MATERIAL

Since natural clays first were used as building materials many thousands of years ago there have been few, if any, fundamental changes in the processes of manufacture. The first building brick was probably molded by hand and baked by the heat of the sun. Later artificial heat was employed to hasten the process of hardening. With the introduction of power driven machinery the process of molding was improved. Experience has pointed the way to superior methods of mixing and preparing the clay for manufacture. But the basic principle upon which brick and clay products are manufactured is essentially the same as that which governed the industry in its earliest stages.

This article describes a new process of making brick. The process involves a simple chemical combination of materials and the resulting product is stronger and more durable even than granite. It is fire proof, frost proof and sanitary. A factory for the manufacture of it is now under construction. The introduction of this process gives promise of marking the beginning of a new era in building construction.

THE industry of making ceramic products or of molding clay or other earthy materials into desired shapes and hardening it by the application of heat was one of the earliest arts engaged in by man. It has been impossible to fix the date at which the use of such materials began. Pottery and building materials of clay composition are found in excavations revealing the earliest stages of civilization. The art was known to all races of people and on all continents of the earth.

Fundamentally the processes of manufacturing brick and ceramic products as practiced to-day have not been materially improved since their introduction. Improvements have, of course, been made in methods of mixing, molding and handling, and advantage has been taken of improved methods of developing power and heat, but the processes of manufacture still involve the selection of natural clay which possesses the property of hardening under the action of heat. The finished product of to-day is perhaps not superior to that of the ancients, and, in some respects, it may even be regarded as inferior. The present-day product undoubtedly does not possess the durability of the ancient product and does not always show the same degree of care and skill employed in manufacture. The brickmaking industry, as conducted under modern conditions, is somewhat stereotyped. A deposit of so-called "brick" clay is located and an empirical formula is developed, according to which the clay is mixed, molded and fired. While deposits of brick clay have been found in many localities, there are many sections of the country which do not possess them, the result being that the cost of good brick in such sections is extremely high, due largely to the expense of transportation. Altogether it may be said that the brick-

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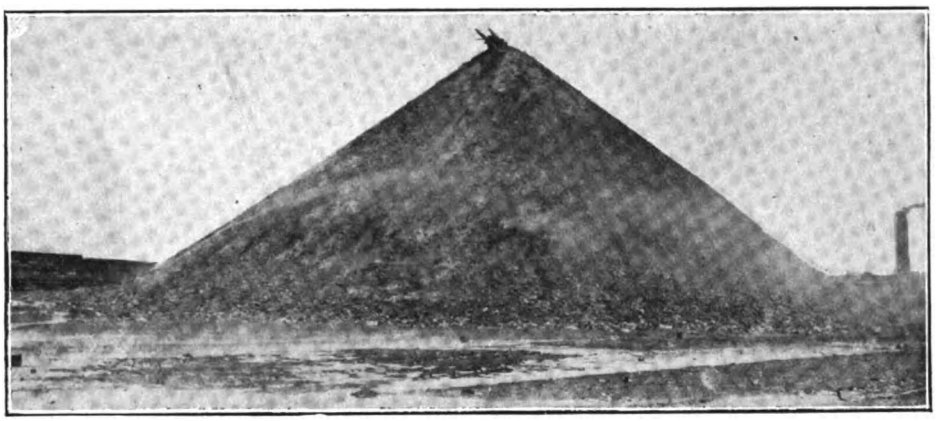

PILE OF TAILINGS *from a coal mine located on the property of the American Brick Company at Lincoln, Ill. End view.*

making industry has failed to progress in a degree comparable to the strides which have been made in other lines.

It is, therefore, a matter of unusual interest and importance to record the development of an entirely new process of making brick; one which is not dependent upon the presence of so-called natural brick clays; and one which may be employed in all parts of the country, and one which offers the most attractive commercial possibilities. Such a process of brick-making has been invented by Mr. A. Malinovszky, a ceramic chemist of long experience in the manufacture of refractory materials. The process has been perfected to a point of commercial practicability after long years of experimenting and has been protected by patents in the United States and foreign countries. A plant to manufacture brick according to the new process is now being constructed at Lincoln, Ill., by the American Brick Company, a two-million-dollar corporation, which controls the patent rights. A number of plants are to be built in various parts of the United States, and the activities of the company will be extended to foreign countries as soon as practicable.

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¶ THE PRINCIPLES *and the process of making the new brick are simple and the results are obtained more quickly than with other materials.*

The process utilizes a simple principle of combining chemically natural materials which may be found in abundance in many localities thruout the world. By-products of many industries may also be used. Briefly, it consists of mixing any coarse material containing silica with a binder of finely divided particles of alumina, silica and potassium or sodium in proportions which vary for the different substances and which may be determined in the case of each new supply of material by chemical analyses. One of the purposes of the process is to obtain a low fusing point for the binder and a relatively high fusing point for the coarse material. The material is molded, preferably dry, under high pressure, and is fired in a manner similar to that which is employed in the manufacture of ordinary brick. The process of firing, however, requires a much shorter period than is necessary in ordinary brick manufacture. The brick can be made in an ordinary down-draft kiln in two or three days.

Since the process was perfected many thousands of brick have been made with the use of various materials. The company has also made analyses of materials obtained from practically every state in the Union and from various locations in each state, a total of 260 such analyses of deposits having been made. Many samples of the finished product have been analyzed by various consulting chemists,

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testing laboratories and geologists thruout the United States, and similar analyses and tests have also been conducted in Germany.

For the purpose of this article it will be sufficient to quote from the reports of a few of the scientists who have conducted the tests. Robert W. Hunt & Co., testing engineers, made some absorption, frost and fire tests on two sample bricks. The following is quoted from their report:

Absorption Tests.

"Two bricks submitted were carefully weighed and immersed in water for a period of forty-eight hours. They were then again weighed, with results as follows:

Specimen marked	A-1	A-2
Color	White	White
Weight before immersion, lbs.	5.109	5.172
Weight after immersion, lbs.	5.250	5.258
Percentage absorption	2.75	1.66

Frost Tests.

"The two bricks, A-1 and A-2, were dimission to tests above, was dried out and placed in a gas-fired furnace.

"During a period of five hours the temperature of the brick was increased to 2900 degrees Fahrenheit and maintained there for a period of one-half hour.

"After being allowed to cool with the furnace the brick was examined. The specimen showed some vitrification, but retained its form, and apparently was otherwise unaffected by the test."

A crushing test of the brick was conducted by Professors Talbot and Abrams, of the University of Illinois. Their findings are shown in the following table:

Results of Crushing Test conducted at the University of Illinois.

Ref. No.	Color.	Weight, lbs.	Section, inches.	Length, inches.	Maximum applied load, Pounds.	Unit load, lb., per sq. in. Over	Remarks.
1	White	5.5	2.25x3.90	7.95	565,000	18,200	Loaded on sides. Cast iron bearing block broke at 565,000 lbs. Brick was apparently uninjured by this compressive load, altho it was broken at the middle as a result of the failure of the bearing block.
2	Buff	5.5	2.18x3.85	7.90	607,000	19,900	No result at maximum load.

These bricks were tested in the 600,000-lb. Riehle testing machine. The faces were nearly plane surfaces. A cushion of three layers of building paper was placed between the loaded faces of the brick and the bearing plates. A hemispherical bearing block was used.

It is interesting to note that the No. 2 sample stood a slight excess above the capacity load of the testing machine, or a unit load of 19,900 lbs. per square inch,

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Weight, after drying 24 hours	2,387
After 24 hours in water—	
Weight	2,389
Water absorbed	2
Per cent. absorption	0.08
After 48 hours in water—	
Weight	2,390
Water absorbed	3
Per cent. absorption	0.13

Weights are given in grams.

Absorption test was made on a whole brick, one 2-inch face of which had been polished. Before placing in water the brick was dried in a steam oven for twenty-four hours. After cooling it was placed flatwise in water to a depth of 1 inch in a covered pan. Before weighing superfluous water was removed with blotting paper. The balance used was sensitive to 1 gram.

Prof. Rollin D. Salisbury, geologist, University of Chicago, made a microscopic examination of several samples of the brick and submitted an article on the subject, the essentials of which are quoted in the following:

"In order to determine the real condition of the material within the brick a series of thin sections, eight in number, were made and examined under the microscope. These examinations showed that in all cases the baking had produced fusion enough among the materials used in the making of the brick to develop a glass (as in lavas), and that this glass serves as a binding material for the original grains which were not fused. These grains are bound together by the glass very much as the crystals of some igneous rock are bound together by the glassy (not crystallized) part of lava. In physical constitution, therefore, the brick is very like a very compact igneous rock which is but partly crystallized. The building material is adequate for strength.

"The texture of the brick is such as to indicate the possibility of a high polish, and the grain is so fine and even that clean-cut lettering and carving should be possible. The composition of the brick is such that lettering or carving should be as durable as in hard rock, and more durable than in marble.

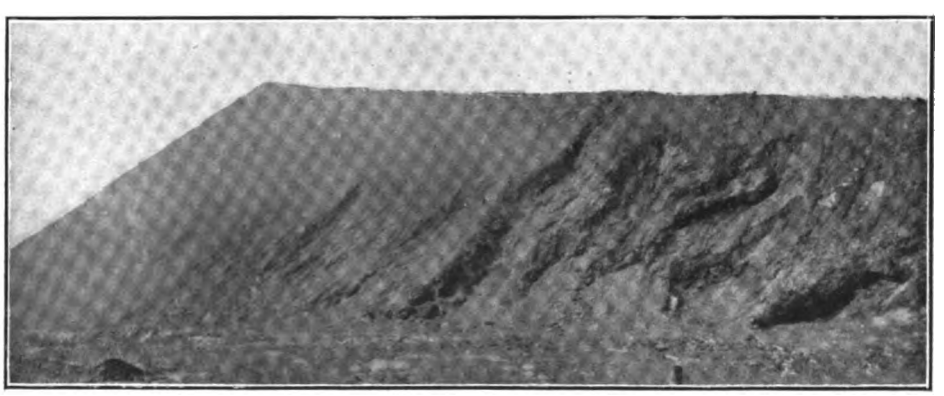
"The materials used in the manufacture of the brick are so plentiful and widespread that there should be no difficulty in finding them in abundance in many places.

"The description of five of the slides follows. The other three are omitted, as they present no features not shown in the five described:

No. 1—A medium-dark gray brick.

"Under the microscope it is seen to consist of grains of quartz, orthoclase, magnetite and an altered ferro-magnesian mineral, in a glassy ground mass. This ground mass was developed in the burning and is the result of the fusion of parts of the substance of the brick. Pore space, about 11 per cent.; but it should be noted that this is not the amount of space that will take up water, for the pores are in the glass and not accessible

SIDE VIEW *of pile of tailings from coal mine, indicating supply of brick material available at this location.*



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to water. The pore space into which water can penetrate is very small.

"The grains of quartz are angular (many) or rounded (fewer), apparently as they were before burning. They show little, if any, sign of corrosion. The corners of the angular grains remain sharp, but there appears to be a very thin film of clear glass surrounding each.

"The feldspar grains, both orthoclase and plagioclase, are much altered on the outside, and grade into the ground mass without sharp demarkation. The smaller grains are altered thruout. Under the microscope the original grains are seen to be broken up into extremely fine fragments, which are bound together by isotropic material. The effect of the heat appears first to have fractured the grains and then to have fused the material along the cracks. The little particles into which the feldspars are broken average about .002 mm. in diameter. There appears to be considerable kaolin, probably such as occurred in the original material from which the brick was made.

"The ferro-magnesian mineral is so much altered that its original character is not recognizable. But little of it is present. It is now altered to magnetite, surrounded by a brownish stain. It grades into the ground mass.

"The ground mass is of glass, filled with minute (about .002 mm.) particles of quartz and feldspar.

"The union of the original particles seems to be as complete as in extrusive igneous rock which contains some glass.

No. 2—A white brick with a pink tone.

"Under the microscope this slide shows more of the glassy base, and therefore less mineral fragments, than No. 1. The constituents are quartz, an altered ferro-mag- by corrosion, there seems to be a thin film of glass around each grain, but this is not in all cases distinct.

"The feldspars are much more altered than in No. 1. The outlines of the original grains may be seen, but they are broken up into small granular aggregates, as in No. 1.

"There are little patches of magnetite and hematite, apparently indications of the former presence of a ferro-magnesian mineral. The original, however, is entirely altered. The ground mass is glass, as in No. 1.

No. 4—Nearly white brick, with very few black spots. Whiter than No. 2.

"Under the microscope very similar to No. 2, so far as shapes of grains and proportions of ground mass are concerned. The angles of most of the angular quartz grains are sharp, but in some cases there is clearly a reaction rim with the glass of the ground mass. The other principal mineral used, probably feldspar, is in most cases altered completely and mingled with the ground mass. Even the original crystal boundaries have in most cases disappeared. There is a little recognizable plagioclase. An original ferro-magnesian mineral is represented now by a stain of yellow and by aggregates of magnetite and hematite.

"The ground mass which binds the original constituents is glassy, but it shows the beginnings of recrystallization, for the glass is penetrated by numerous fine needle crystals, noticeable only with high powers of the microscope. This is a characteristic seen not rarely in solidified lavas.

"Pore space about the same as in No. 2.

No. 5—A mottled, fine-grained, red-white-black-gray brick.

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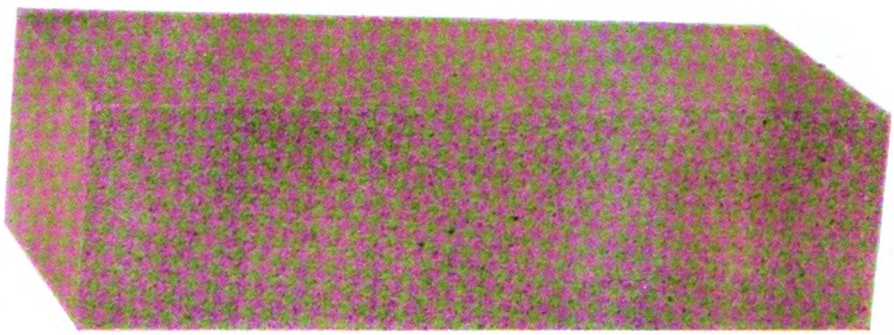

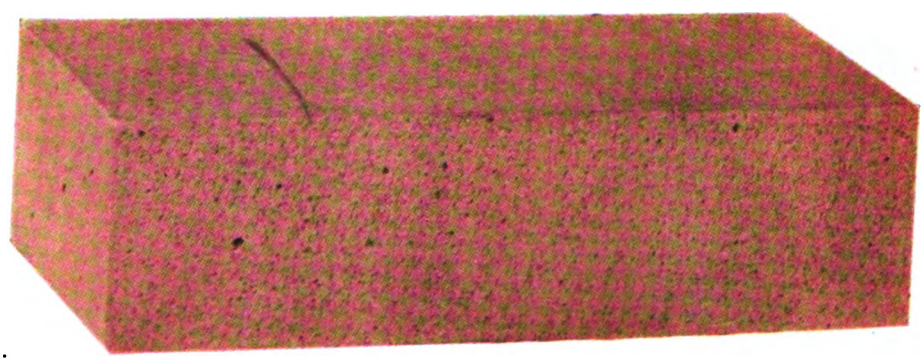

FACE BRICK, not polished, shown in true colors.

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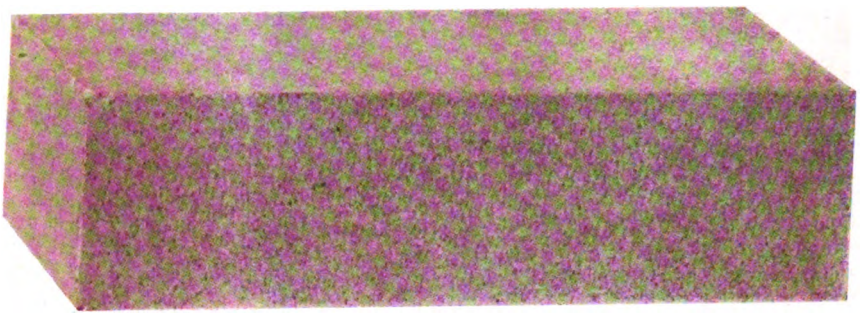

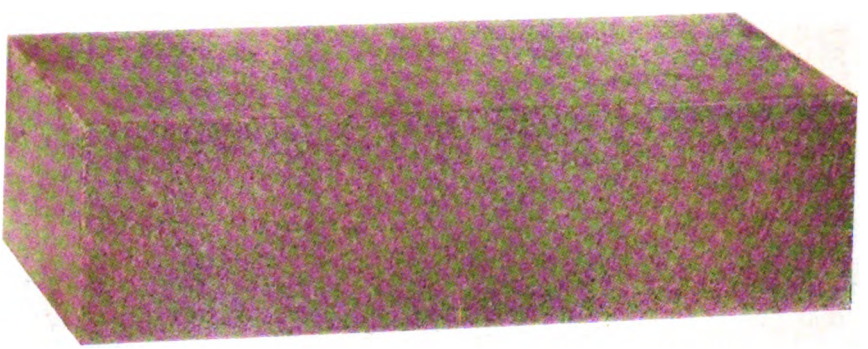

POLISHED FACE BRICK, shown in true colors. The structure is fine and the appearance more beautiful than French Granite.

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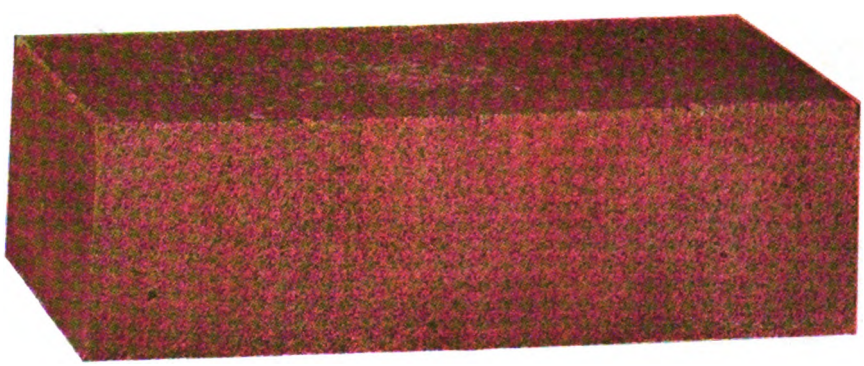

ROSE TINT FACE BRICK, not polished, shown in true colors.

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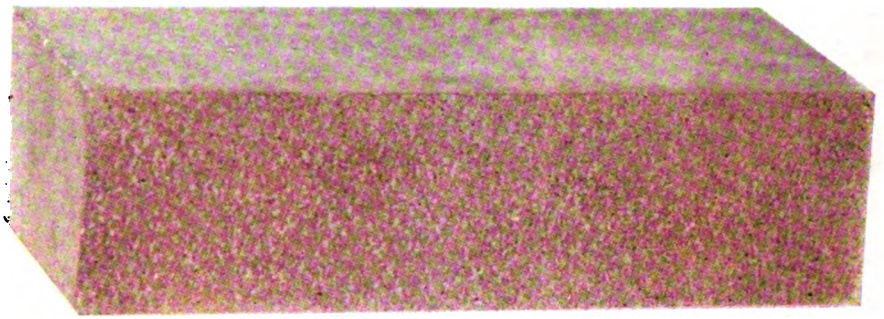

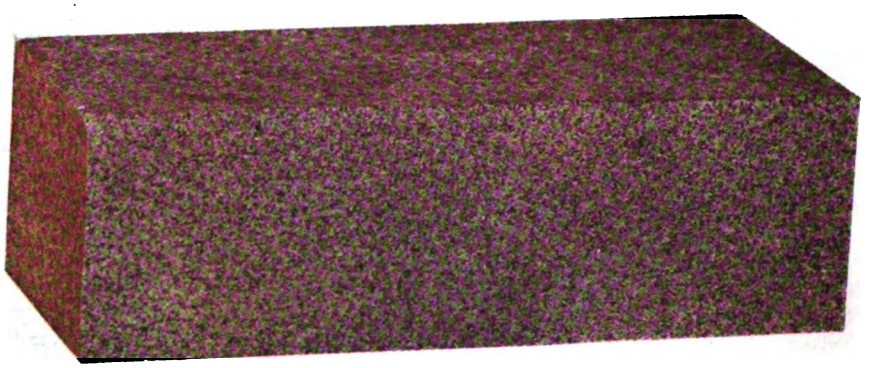

POLISHED FACE BRICK shown in true colors. The colors are as delicate and soft as those of an oriental rug.

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that two kinds of feldspar may have been present. Some of the grains appear now only as a mass of glassy material shot thru with a felt of fine secondary needles.

"Iron oxide is much more abundant than in any of the preceding. It appears in the form of a yellow stain, as hematite and as magnetite. Kaolinization present in the feldspars, but this may represent the condition of the original material.

"The ground mass is clear glass, or glass full of grains and needles.

No. 8—A yellowish brown, fine granular brick.

"Under the microscope, similar to No. 1 in size of grain and in the relative proportions of ground mass, and included mineral fragments, but it contains more iron oxide.

"Quartz grains are rounded and angular. The angles are sharp, showing very little reaction due to heat. Granulation of the feldspar as in No. 1, but the outlines of the original grains are clearly recognizable. Not so much altered in the baking as Nos. 4 and 5; occasional plagioclase grains, hardly altered. Most of them, however, are broken up and grade into the ground mass as in the previous cases. There is much iron oxide occurring as a brown stain, and as grains of hematite and magnetite, scattered uniformly thruout the mass. There is greenish stain of chlorite, derived from some original ferro-magnesian mineral."

Prof. Dr. H. Seger and C. Cramer, chemists and chemical engineers, of Berlin, Germany, made an elaborate analysis and examination of samples of the brick. The essential facts brought out by their report are given in the following quotation:

"We received a sample of brick of a grayish white color with dark spots, and also a brownish sample.

"Results of the analysis were as follows:

"In determining the porousness it was found that the lighter sample of brick absorbed 2.8 v.H. (per cent.) of its dry weight of water, and the brownish sample 5.1 v.H.

"To determine the compressive strength we sawed cubes, 5.5 cm. long on the edge, from the samples, and analyzed these in the usual manner to determine the compressive strength, with the following results:

Lighter Sample.	*Darker Sample.*
1500 kg. per sq. cm.	928 kg. per sq. cm.
1392 kg. per sq. cm.	782 kg. per sq. cm.
Average—	
1446 kg. per sq. cm.	855 kg. per sq. cm.

"We then analyzed the samples for the purpose of determining their resistance to frost. This test proved that the brick does not scale.

"In the pyrometric determinations, which were made by comparison with Segerkegeln, the lighter sample began to melt with Segerkegel 13 and the darker sample with Segerkegel 13 to 14.

"The preceding determinations yield the following facts:

CLOSE VIEW *of material from which the American Brick Company will manufacture their product in their Lincoln, Ill., plant.*

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"If the bricks sent to us may be considered as representative samples, the brick consists apparently of ground natural stone which has only a slight porousness and a high compressive strength; this is especially true of the lighter sample. The samples may be designated as impervious to frost. Their melting point is approximately the same as that of granite.

"The samples analyzed may be utilized for hydraulic structures, foundations, and for street and sidewalk paving."

It is interesting to note, in connection with the statement made in the Berlin report quoted to the effect that the melting point was found to be approximately the same as that of granite, that European granite or German granite possesses much higher refractory qualities than American granite. It is also of finer texture.

It is proposed in the Lincoln, Ill., plant now under construction to manufacture the new product from the tailings of coal mines, the material not being suited to any other purpose because of the high percentage of lime, sulphur and iron contained in it. The process, however, is such as to enable the use of this material with entirely satisfactory results. The presence of iron in a finely divided chemically combined state produces in the surface of the finished brick splashes of dark tan, which, on a background of light tan, give a most attractive and unusual appearance to the product.

Photographs of the material ready for use in the first plant are presented herewith. It contains approximately 200,000 tons of usable raw material.

The brick takes a very high polish, and when polished presents an appearance very similar to that of granite. It is, however, of closer grain than granite, a characteristic which will probably enable it to retain its polish for a longer period than granite. Photographs of several samples of the brick, reproduced in true colors, are presented herewith.

Mr. A. Malinovszky, who has worked out and perfected the process, was born in Austria in 1875. He comes from a family of ceramic specialists. His early life was spent at work in his father's pottery factory. He came to America in 1903, and since that date has done a considerable amount of special work in pottery factories, in the Edison plants at Orange, N. J., and in the plants of the General Electric Company, at Schenectady, N. Y., in the latter of which he was engaged in the insulating department.

The president and active head of the American Brick Company is Mr. H. H. Randolph, a young man of broad business experience and unusual energy and capacity. He was formerly engaged in the investment banking business in the city of Chicago, and gave up a well-developed and profitable business to devote his entire attention to the interests of the American Brick Company.

The engineering work in connection with the development of the plans for the machinery and the plant layout has been done under the direction of Mr. J. E. Boynton, formerly with the Arnold Company, Chicago.

The American Brick Company is a Delaware corporation, having a total capital stock of two million dollars. Subsidiary companies have already been organized in several of the states to handle local territory.

Carefully prepared estimates have been made of the cost of producing the new product. These indicate that it will be possible to place it on the market in competition with any of the high-grade face brick now available.

A detailed study of the process and of all facts bearing upon the commercial aspect of the problem makes it evident that this new product will take a most important place in the field of building materials, and that its introduction will result in the development of many new types of construction which are not now possible with building materials in common use. The new product can be made in any desired shape and of practically any size. The American Brick Company has already developed plans for new types of construction, and these possess so many attractive features as to recommend them at once to structural engineers and architects.

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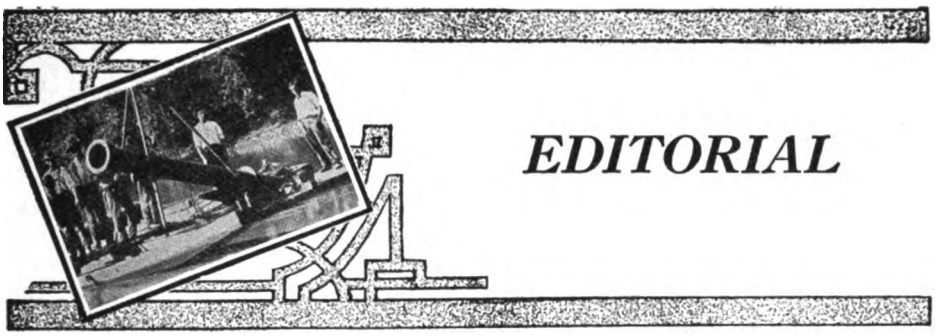

EDITORIAL

THE NEW SIZE OF MUNICIPAL ENGINEERING.

For twenty-five years MUNICIPAL ENGINEERING has been published in magazine form with a printed page approximately 5 inches by 8 inches. In recent years there has been a commendable tendency on the part of publishers to standardize the size of publications. In the technical and trade field a size of 9 inches by 12 inches with a printed page 7 inches by 10 inches has become standard. The next issue of MUNICIPAL ENGINEERING will be of this standard size.

Before deciding to make the change the opinions of many readers of the publication were secured. These were overwhelmingly in favor of the new size although a considerable number felt that the present smaller size possessed some advantages and conveniences which the larger size did not have. The change has been decided upon in order to meet the wishes of the majority of the readers.

MUNICIPAL ENGINEERING will also have a new cover design for the new size. It was the first publication in the engineering field to use the full page half tone cover which is now used by a number of publications. The new cover design will be as unusual, distinctive and attractive as the old design was when first used about three years since.

CHEAP STREET TRANSPORTATION

The jitney bus, the operation of which is analyzed on another page, has frightened street railways in the cities where it is making inroads on their daily receipts, and Cleveland newspapers seem to be frightened in advance at the prospect of interference with the income from 3-cent fares, in which case fares will increase automatically when the reserve fund reaches its lower limit.

In general it is probable that these fears are not well grounded, tho there may be a few cities under special conditions, such as Los Angeles, at almost any time, San Francisco and San Diego during their expositions, and others in which street car service is poor or not sufficiently extended in which the service will be permanent.

The first jitneys were started in consequence of a strike when their

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Plenty of work will draw off most of the present owning operators of jitneys. The wearing out of the machines will stop the lines started by automobile garage owners and over-crowding of routes will discourage others. The better times toward which we are now evidently traveling will, in short, cut the business down to a minimum.

It is probable, however, that there will be a certain amount of the business in some cities during the rush hours of mornings and evenings so long as there are autos not otherwise engaged at those hours, whether owned by private parties or by garages or taxicab companies. The street railways may therefore expect a reduction in the over-crowding at the rush hours, which will be welcome to their patrons, so that what is the loss of one is the gain of the other. The effect upon street railways charging less than a five-cent fare will be much less appreciable, and Cleveland's 3-cent fare will probably make the jitney bus competition practically negligible. The average ticket buyer on a street railway will think some time before he will regularly pay five cents for what he has been accustomed to get for three or four.

CITY MANAGERS

The communication on city managers in the west in the department "From Workers in the Field," shows that charter-making without careful study and advice from experts is likely to bring the city-manager plan into disrepute even in the homes of its friends. It is necessary to mention but one subject to show how personal preference by those influential in preparing the city charters have fixed provisions with little real knowledge of the effect those provisions may have.

The method of discharge of the city manager is one of the points upon which there is the most difference of opinion. It seems to be difficult for the average charter maker to see that he cannot have the independence of action which goes with responsibility at the same time that he keeps the control of action directly in the hands of the voters. He does not see that he cannot get a really competent and honest man for an office from which he may be removed at any moment on account of the caprice of a man, a board, or an electorate. Practically all of us are so thoroly imbued with the idea that politics is rotten and that it cannot be kept out of municipal affairs, that we are not willing to try the experiment. The consequence is that we have certain peculiar provisions contained in the charters noted in the communication referred to.

If we will follow the principles which have demonstrated their success as carefully as we are trying to get away from those we feel are failures, we will soon begin to see some improvement.

The cities having the commission form of government are trying to follow one of these principles, that of nonpartisan nominations and elections; the city of Dayton is trying to follow another, the merit system, tho a real merit system can not be fully in force until there is sufficient demand for skilled municipal employes to warrant men in preparing themselves for such positions; the state of Ohio and some of the western states are trying the third principle, that of home rule, tho the Ohio plan may be overturned in part at least by the legislature at any time. Home rule will not be safe until it is impossible for a man, who cannot do what he wishes with the city government, to go to the legislature and procure a change of the city charter which will give him the authority he wants in spite of the desires of the people of the city.

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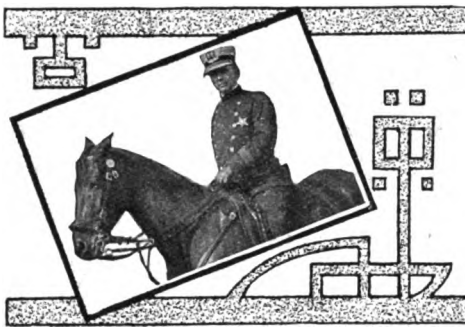

QUESTION DEPARTMENT

Franchise for Electric Light and Power Service

Our town has been approached by one of the hydraulic power companies for a franchise with a thirty-year contract for light and power, with specified rates. We have had an unpleasant experience with an oil engine which is being discarded for a steam plant, and which will be ready in two or three months. Our steam plant will have a 150-h.p. engine with two 125-h.p. boilers.

We wish to obtain information as to the rate for light and power, the cost of operation and all the statistics necessary for arriving at average and reasonable rates and a fair contract for towns and citizens situated as we are.

If such information has been published in recent numbers of MUNICIPAL ENGINEERING, please refer me to it.

S., ———, Tenn.

In the February number of MUNICIPAL ENGINEEIRNG, vol. xlviii, p. 89, will be found an abstract of a franchise for electric light and power and water service which is in most respects modern and provides for modifications of rates at intervals in case this is desirable. Rates for electric current and electric service have changed so much in the last thirty years and the developments in electric lighting are now so rapid that no contract fixing rates for thirty years, or even for ten years, should be made by a city.

In this number of MUNICIPAL ENGINEERING will be found another article giving a method of paying for street lighting which is very attractive because at the same time it provides for any improvements in fixtures which the city is willing to pay for and removes any uncertainties as to relation of service to payment for it, which should be of benefit to both parties, but probably of most benefit to the city because ordinarily the company knows much better what it is doing in making a contract than do the city officials.

Such a contract as that considered should be worked out with the advice of engineers experienced both in electrical engineering and in franchise construction. They may be able to save the city and the private consumers many times the amount of their fees, and will do so unless the company is much more public spirited than corporations are wont to be.

This is particularly true since it is proposed to abandon a municipal plant now about ready to run. It is quite probable that a large hydraulic plant can furnish electric current at a lower rate than a small steam plant, and in that case it is good business to purchase the current of the company. Again, it may be better for the city to purchase current and distribute it to its citizens, or it may be better to contract with the company to distribute as well as supply the current. These are questions on which the advice of the expert electrical engineer should be sought.

Bituminous Streets Damaged by Street Flushing

Can you advise us of any tests made of the actual extent of damage done to pavements of a bituminous composition by water used in flushing the streets? The general opinion seems to be held that water, especially water under pressure, is damaging to the pavements: but just to what extent we have been unable to learn. Any facts you may be able to give us in this matter will be greatly appreciated.

N., ———, Cal.

A paper on "Street Cleaning Methods and Results," in MUNICIPAL ENGINEERING for September, 1914, vol. xlvii, p. 176, gives satisfactory and unsatisfactory methods of street flushing, showing that good methods produce good results.

Satisfactory machinery for flushing streets is described in articles in vol. xliv, pp. 57, 160, 284, 439; vol. xliii, pp. 118, 344.

An article on "Cost and Efficiency of Street Cleaning Methods," vol. xl, p. 32, gives figures of cost for various methods, including flushing, and references to earlier articles giving further figures. Another list of earlier articles will be found on p. 427.

Articles opposing the practice of flushing for cleaning streets will be found in vol. xl, pp. 131 and 132, and vol. xxxix, p. 316.

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The writer's observation is that machines with flushing streams properly distributed and directed and using pressures not too high are no more destructive to pavements than are dry or sprinkled broom sweepers, but that hose flushing as ordinarily practiced and badly designed nozzles for flushing machines may be very destructive.

Can our readers give any comparative figures regarding flushing as compared with other methods of street cleaning as to effects on pavements?

Ordinance Creating City Forester

We have a request from an Indiana city for an ordinance creating the office of city forester. We do not know whether in Indiana the municipality has power over its trees under charter authority, or by virtue of a state law, and we therefore would like to have you refer us to an Indiana city that already has one in effect.

T., ———, Chicago, Ill.

The city of Indianapolis has a city forester provided for under its park law, which does not require an ordinance to put it into effect. The provisions of the New Jersey act of 1893, with its amendments, is an excellent basis for an ordinance governing a city forester, tho it provides for a commission with a forester acting under it. Can our readers send copies of such ordinances now in operation?

Specifications for Automobile Fire Apparatus

We have a small city which covers a large amount of territory, considerable of it beyond our water mains. Our water mains are old and very frequently we have leaks after we have been compelled to put on extra pressure during a fire. We have paved streets leading in nearly every direction towards the limits of the city, but most of our streets are sandy.

Can you give any information about what we ought to require in the way of a motor-driven hose cart, and also the cost of same?

Can you also give me any information about what advantage it would be to the city to have a pump as part of the apparatus, considering the condition of our mains and also our streets?

Our central fire station is in the center of the city. Pressure at the pump house normally is about 45 pounds higher than pressure at the central fire station, on account of difference of elevation. During fires the average pressure at the fire station is 60 to 65 pounds,occasionally going as high as 75 to 80 pounds in bad fires.

H., ———, Minn.

Real answers to these questions could only be given after a careful personal examination of the local conditions. It is evident that the water distribution system needs improvement and extension. Within the area covered by the water pipes a combination of pump and hose would be very valuable on the motor, as it might not be necessary to overstrain the water pipes by putting on full fire pressure. Outside this area the pump would be of use in reaching houses now nearly or quite out of reach with the pressure in the mains.

Pending the improvements in the water system the combination machine would, therefore, seem to one not familiar with the locality to be very desirable.

Can any of our readers send specifications for the class of machine they have purchased for use under similar conditions? Specifications throwing the competition open to all makers of satisfactory machines are, of course, preferred.

What Is El Oso Asphalt

Will you please inform me as to the nature of paving asphalt called "El Oso"? I would like to know its origin and any other information about it. SUBSCRIBER.

This is a name given to an asphalt for for paving purposes which has been used at lettings in several different places and seems to be given to a California asphalt. Will any of our readers give information about it? The writer has a sample of bituminous macadam pavement from Wellington, Kan., which is called "El Oso Pavement."

Strains in Pavements

The writer is informed that you published in one of your issues last spring some information about tests of vibration of pavements conducted by the Bureau of Public Roads.

G., Consulting Engineer, New York.

"Temperature Strains in Brick Pavements," by James E. Howard, engineer-physicist, U. S. Bureau of Standards, Washington, D. C., is possibly the article referred to, as the experiments described in it had the co-operation of the Office of Public Roads. This article appeared in vol. xliii, p. 381, December, 1912.

Dust Laying on Streets and Roads

I would like a report on water-bound macadam and the laying of dust and the best means of doing it on street pavements that require something besides water.

A book by Prevost Hubbard on "Dust Preventives and Road Binders" ($3) gives full information on all classes of dust preventives. Probably the class of temporary binders is the one referred to in the question. This includes water, sea water, calcium chloride, sodium silicate, tar, vegetable, animal and mineral oils, particularly semi-asphaltic oils, glutrin or prepared waste sulphite liquor, and other waste products, such as molasses residues. The book gives full descrip-

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tions of all these materials, specifications for their quality and use, and methods of applying them.

The U. S. Office of Public Roads, Washington, D. C., has issued several progress reports of experiments in dust prevention and road preservation, which give the practical results of the use of several materials used for such purposes.

Information on Regulation of Street Traffic

I would like to have numbers of MUNICIPAL ENGINEERING containing articles regarding street traffic and its regulation.
C. H. P., Philadelphia, Pa.

Following are the most recent articles on this subject:

In vol. xlvii: "Ordinances Providing for Vehicle Licenses," p. 124.

In vol. xlvi: "Ordinances Governing Street Traffic," p. 117, also vol. xliii, pp. 38 and 388; "Congestion of Traffic on Fifth Avenue, New York," p. 433; "Regulating Standing of Vehicles in the Street," p. 123.

Berkeley Park Bathing Beach, Denver, Colo.

The Berkeley Park bathing beach in Denver, Colo., is one of the more recent developments of this sort in the city, and is not yet fully worked out, but the natural beauty of the location, as evident from the photograph, and public favor and demand will soon produce the necessary improvements. The bath house is thoroly modern, with eight shower baths and constant supply of hot water. The women's dressing rooms have four showers, a sun bath, twenty dressing booths and 150 lockers. The bath house and beach are operated by a concessionaire, who pays the city $1,000 a year for all the park concessions. Suits were provided last year for 600, but on Saturday and Sunday afternoons as many as 1,500 have enjoyed the bathing, many supplying their own suits.

The supervisors of the Denver playgrounds encourage playground leaders to use the pools for their groups of boys and the Berkeley playground leaders offer swimming lessons each day in the season, from 11 to 12 for little girls, from 2 to 3 for small boys and from 6 to 7 for older boys, all under the care of life guards and with all possible precautions against accident. A life-saving class is also conducted, teaching the use of the pulmotor and various methods of rescue and resuscitation.

BERKELEY PARK *bathing beach, Denver, Colorado, one of the playground accessories, which is extremely popular with the young of all ages. Improvements are made on it each year.*

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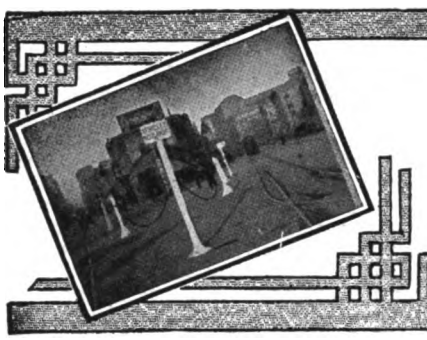

WORKERS IN THE FIELD

Dayton's Effort at Solving the Problem of the Unemployed

The Editor of MUNICIPAL ENGINEERING:

Sir—The general business depression during this winter found many worthy people without work. Some factories were running short time; all had lessened the number of their employes. The merchants suffered, as every one curtailed expenses. A bond issue of $250,000 for extension and reinforcement of the water system had been passed. Fifty thousand dollars additional was available, as this amount had been saved on water works construction done by the city employes during the past summer. This meant over $150,000 available for pay-roll purposes as soon as work was started, tho the pipe, valves and special fittings had not been ordered, as this work was to have been done after the weather opened up.

City Manager Waite gave orders that work would be commenced on Monday, December 21, this order being given the previous Thursday. It further called for the employment of 200 men, or as many more as needed the work or could be handled. Fortunately the contract for the pipe had been placed and the foundry was called on long distance and asked just what they could do. The result was pipe inside of four days and special castings for bonds, crosses and the like as soon as these could be completed. Notices were posted for all wishing work to appear.

Tags were prepared with serial numbers and districts stamped on same. (District A, 1843, for example.) These were given to all who applied at the office. Advice was furnished and notices posted for all to report at respective jobs called for on these numbers. As many men as could be handled were taken on the first day and the rest advised to come back in rotation as called for by the numbers issued. The men were paid off each day, and if their work had been satisfactory a new ticket with a number which put them at the bottom of the list was given each man. The majority of the men did most excellent work. It meant earning money for food instead of want or charity. They appreciated it and the effort the city was making to help them out. Cost sheets showed some of the work to have been done, with ground frozen eighteen inches deep, by men foreign to the business, for less money than that done by the old construction gangs under previous management. It was simply the American man doing his best and overcoming the obstacles.

The system furnished money for food, the men at first getting an average of one day's work in six. Almost every afternoon, as the men were paid off, many had either wife or child present with a market basket, and the money would immediately be turned over to purchase food. A number of days the men were paid off near saloons, and, in spite of weather as cold as 15 degrees above zero, no money appeared to go for liquor.

The pay roll was handled by a timekeeper who visited the jobs, took the men's names and inspected their numbers. With this data he and the chief clerk of the department of water made up the pay-roll. As the men changed each day, it was either a case of having them make an extra trip or else pay them that evening. The latter meant the easier for the men, so each afternoon the superintendent, who issued the work tickets, the cashier and the time keeper made the rounds. On reaching a job the foreman went through the gang with the pay men and each man received his $2 on receipt of his number and name, which was checked. After paying the men the foreman certified the men as having been paid, after first seeing that his own time book checked with the pay-roll. For six weeks we have paid daily from two to three hundred men, at places requiring over ten miles of driving in a small Ford car, and have never taken over two hours or held the men more than ten minutes over their eight hours.

The system was taking care of a thou-

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sand men and doing a good work. The money paid went directly into circulation again and so worked many times. However, the system could be beaten, and men were doing it. In the first place, some men were not satisfied with work every four days and wanted more, and so worked two tickets at the same time, no check being provided over their issuance. In the second place, men who did not belong in Dayton obtained work, and so made less for the real Dayton men. The third problem was the foreigners, who swarmed after work.

The foreign problem was solved by allowing the foreign labor agencies and the foreign churches so many tickets each day. The repeaters were taken care of by simply catching the faces at first and putting them off the job for good, and later by checking each man's record. The third was taken care of at first by looking each man up in the city directory before giving him a ticket. Foreigners with property or naturalization papers were allowed to work. The idea was not to discriminate against them, but merely to help the men with families who needed it the most.

In order to reach those most needy, cards were gotten out containing the following information:

Name..... Address.....
Age..... Number Dependent.....
Occupation..... Last employed by.....
Time out of work.....

—To be filled out by Police Officer.—

Above satisfactory.....
Need Work.....
Time in Dayton.....

The card as indicated is filled out by the man and a number is given after the police officer has reported, which takes one day. A clerk in the office goes over each pay-roll and enters up the job the man works on, the date and the number used for the work. Also the report of the foreman as to nature of work done, the letters F, G, or P indicating whether the work was fair, good or poor. If a man gets two P's he is transferred to some other foreman, and if he again gets the two P's he is relieved from work. The actual work done is not considered as much as whether the man tries. We get old men who can not do the work and still need the money. The effort is what really counts.

Since the gang has been weeded out, we are giving one day's work in four. The men are posted as to their turns by bulletins issued daily and posted on the jobs and in the office, which show what is the low number to be called and the number of men that will be worked. That way men know when their turn comes without being there every morning, and so have chance for seeking better employment or doing other odd jobs.

The system is simple and it helps the men. The money goes into circulation at once and helps Dayton. One pipe gang laid twenty-six 12-foot lengths of 20-inch pipe in eight hours, all of which tested O. K. on the joints, so it is evident that the benefit is mutual. The work was started without knowing just how it would turn out and before a system was perfected. However, if every town would get the idea and go to it, the era of prosperity hoped for would be hastened.

H. C. WIGHT,
Superintendent, Division of Water,
Dayton, O.

City Managers in the West

The Editor of MUNICIPAL ENGINEERING:

Sir—Following the installation of the city manager in Dayton, Ohio, cities and towns of the west became alive to the opportunity for advancement in municipal science. In a hundred places municipal officials and business men appropriated the good ideas that sifted out of Dayton and planted them as seed from which have grown the excellent systems now in vogue in a number of these places.

Montrose, Col., prepared to throw off the aldermanic form of government at the earliest possible moment, and early in 1914 the commission form was substituted with provision made in the charter for the position of city manager. The Montrose charter has been considered a model among towns of several states.

The Montrose charter, among other things, embraced initiative and referendum and recall provisions, and, while it gave the commissioners power to discharge the city manager, it also provided that the city manager should be subject to recall. While the framers of the charter looked forward to a much improved form of government that would be honestly and efficiently administered, they took no chances of having a contrary commissioner refuse to discharge a city manager if he was found dishonest or incompetent. The commissioners may elect the city manager by a majority vote, but can not discharge him except upon a unanimous vote. In that connection a clause of the charter is interesting, in that it gives the mayor the right to vote but deprives him of the right of veto. The Montrose charter clings closely to the old-time fundamentals of city government, but it embraces a lot of new ideas about management and details.

The Amarillo, Texas, charter calls for a standard of efficiency in the city manager that is extraordinary, for he may be oust-

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ed from office over night. More than that, it provides that he "shall be the administrative head of the municipal government, and shall be responsible for the efficient administration of all departments. "Like most of the other late city charters this one prohibits the city manager from employing relatives in the service of the city. This charter steps out of the beaten path in another particular: It provides that the city manager nor any other person in the employ of the city must not accept free passes to theaters and other kinds of shows nor "accept a personal favor of any intrinsic value from any person, firm or corporation with whom he transacts official business, when such favor would be in recognition of his official position."

City Manager Hardin, of Amarillo, first suggested the idea of a congress of city managers. But that idea was second best among a number of ideas that have made Amarillo one of the best governed towns in the country. His best idea was that there should be a board of city development, and it bore fruit. A few months ago there was organized there the first municipal board of the kind in the United States. This board embraces twelve departments, each with a separate head. A secretary and an assistant secretary are employed full time to look after the business of the board. "In other words," says Hardin, "it is a chamber of commerce organized as a part of the city government and supported by all the people, and it works."

"My plan has been to eliminate all unnecessary help," says Manager Hardin, "and to require of every man employed a full day's work. But we have given men sufficient pay to make them like the work and take a pride in being a part of the city machinery. We have no old men on the city pay-roll and no pensioners."

The commissioners of Collinsville, Okla., and Abilene, Kan., being at the head of city governments where many municipal improvements requiring the service of an engineer were to be made, looked well into the engineering records of their applicants for city manager, and they probably have chosen two of the best that were available, if the accomplishments of these men are an index to their qualifications.

City Manager H. B. Schwartz of Collinsville was an engineer by profession, having begun his career in machine shops in Marion, Ind. He built the first light and power plant at Bartlesville, Okla., and was its superintendent for six years. He had also two years' experience in city government as a member of the City Council of Bartlesville. In 1912 he was employed as superintendent of the municipal light and water plant at Collinsville when it was earning a revenue of $240 a month. Under his management in less than two years it was earning a revenue of $1,700 a month. Later he acted as engineer for the city and made a saving of $2,000 engineering fees in making extensions to the light and water system and building a city hall. He has made a saving in every department of the city government, established efficiency and cut out the waste.

There seems to be no end to the powers and duties of the average city manager in this section. The charters are all about alike in this respect, but probably Abilene, Kan., has a slight lead. Here are the duties of City Manager Kenyon Riddle of Abilene:

To see that all laws and ordinances are enforced; to attend all meetings of the commisison, with the right to take part in the discussion but having no vote; to recommend to the commission for adoption such measures as he may deem necessary or expedient; to give all lines and grades for city improvements which require the same; to have control, management and direction of all improvement work of any nature which pertains to and comes under general engineering principles; to be inspector of all wiring, sewer connections and chimney construction; to approve all estimates of the cost of public works and recommend to the commission the acceptance or rejection of the work done or improvements made; to recommend to the commission the appointment or removal of all heads of departments and all subordinate officers and employes of the city which come under and pertain to principles of engineering; to exercise control over all departments and divisions created by the commission; to keep the commission fully advised as to the financial needs of the city, and to draw his salary.

Manager Riddle has prepared a symposium relating to the duties and qualifications of the engineer-manager. "The manager," he says, "should be without extensive interests in the community which he serves. This makes it possible for him to give impartial views in matters concerning employment of labor and purchasing material.

"His preparation should consist in a thoro education along the lines of general engineering rather than of a knowledge of a few special branches. He should have an understanding of values and be able to estimate all classes of construction and maintenance work, be economical and able to establish systems of record keeping and cost data and have a general conception of business methods and finances.

"Some of the dissipation of tax money is due to graft, etc., but most of it is the

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result of poor management, lack of harmony among the board members and a lack of knowledge along particular lines, especially in the engineering department of smaller towns and in the purchasing department of nearly all municipalities. Therefore, in consideration of the small towns, the main object in order to secure efficiency where it is most lacking is to devise some scheme whereby the town can feel justified in having the services of an engineer at all times, and this remedy lies in the engineer-manager plan.

"With the engineer-manager it is possible to get the very best and most active business men to serve on the commission, since their duties are reduced to a few hours a week. Furthermore, it is generally admitted that the holding of a political job is not a successful means of increasing one's business, but under the new plan all complaints and grievances may be put up to the manager. By hiring a manager the hindrances of politics are eliminated and professionalism is substituted."

W. F. KERR,
Oklahoma City, Okla.

Motor Snow Plow and Sweeper

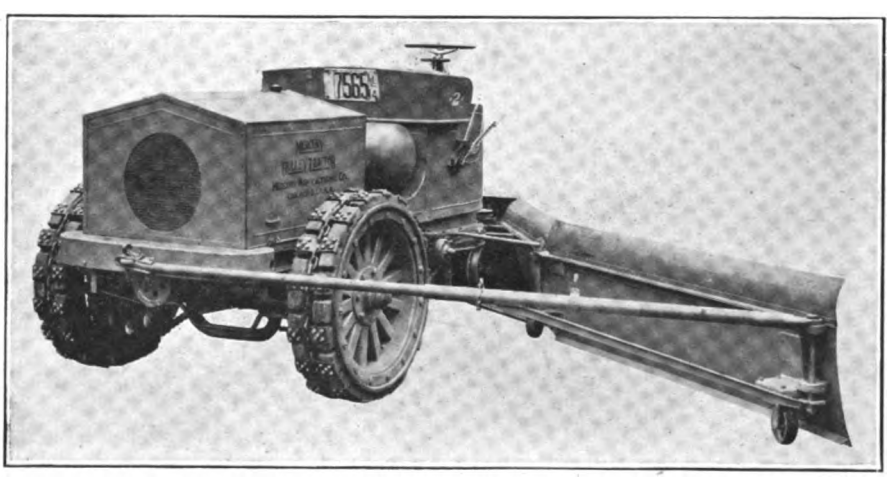
The removal of snow from city streets and drives is a costly but necessary procedure, and every hour's delay not only makes the final removal more troublesome and expensive, but adds to the difficulties of road vehicle operation. Every inch of snow decreases the efficiency of horse-drawn equipment, and the longer it remains on the streets the greater is the loss to merchants with deliveries to make and the more seriously is the public at large inconvenienced.

Were it possible to quickly plow out a roadway and bank the snow to the curb or in the center of the street, the final removal could be made more cheaply and traffic delays would be greatly reduced. If the street car companies did not send out electric sweepers as soon as there were indications of a heavy snowfall, the lines would be hopelessly blocked in a few hours. To do the same for the lines of other vehicle traffic motor-driven snow sweepers and snow plows must be used. The power unit must be compact, sturdily built, easily manipulated, capable of securing traction on any kind of snow or ice-covered street without injury to the pavement, and of sufficient power to break up frozen drifts. A tractor with these qualities can push the snow plow, a rear view of which is seen in one of the photographs, or draw the sweeper seen in the other.

The snow plow resembles the very effective railroad plow more than the ordinary road scraper quite generally used. In the road scraper there is a single blade set at an angle, slightly curved and rigidly attached to the vehicle, but capable of being adjusted vertically by the operator, and in some cases a change of angle is possible. The plow shown in the photographs is flexibly attached to the power unit, rests upon its own wheels, and is free to articulate and conform with the road surface, regardless of the position which the tractor may assume.

The V-shaped main member in front is properly formed to lift and displace the snow to the best advantage, and an arm eight feet long is attached to the right-

REAR VIEW *of motor snow plow, showing method of flexible attachment of extension blade carried on two small wheels.*



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hand rear of the V-shaped piece, which is easily adjustable so as to increase or decrease the throw of the plow. The main member may be used without the extra arm. The rear ends of the main member are supported on two caster wheels, and the front on a flanged guiding wheel, mounted on a fork and turned by a gear and wheel arrangement directly attached to the tractor steering turntable. The framework is of heavy channel and angle iron, riveted and welded together. The heavy bent plates forming the blades are riveted in place and reinforced by channel-iron ribs and angle-iron lengthwise members. There is less than than one-half of an inch clearance between the plow and the ground, which insures a clean street. The V end is fitted with a strong prow, so that when an obstable is met which cannot be plowed aside, the plow either mounts over it or sheers to one side.

The snow plow is attached to the tractor at three points, but none of the connections are rigid. A detachable forging is fastened to the front of the tractor by two bolts and thru a hole in this forging the vertical driving post of the snow plow passes. The rear end of each side of the main member is flexibly attached to the tractor frame by a bent round iron passing thru a swivel bolt. The flanged guiding wheel, located just behind the point of the plow, is actuated by two heavy steel wire cables attached to the tractor steering turntable.

The extra plowing arm may be attached to the rear end of the right side of the plow by a long swivel bolt. The rear end of this extra arm is supported on a caster wheel and connected with the rear of the tractor by a braced, telescopic extension rod. The length of the rod can be quickly adjusted to give the extra arm a throw of from nothing to six feet.

When entering a wide street the plow first opens up a furrow from 8 to 14 feet wide, depending on whether the extra arm is swung open or not, then it returns on either side and banks the snow against the curb.

Two of the tractors, one equipped with the snow plow and the other drawing a snow sweeper, as shown in the photographs, were used in cleaning Michigan avenue, Chicago, during the heavy snowfall January 20 and 22. With suitable approaches they mounted the wide sidewalk along Grant Park and first plowed out a passageway and then swept the walk clean. When the snow first began to fall, the motor-drawn sweeper cleaned up the avenue easily, but the storm increased and the plow went to work, first opening up a passageway, and then banking the snow at the curb and also in the center of the street. The sweeper followed and left clean pavements for the automobiles.

MOTOR SNOW PLOW *clearing park driveways of deep snow. Note ease with which it handles the snow.*

MOTOR SNOW PLOW *drawing a sweeper to clear the pavement after the plow has done its work.*

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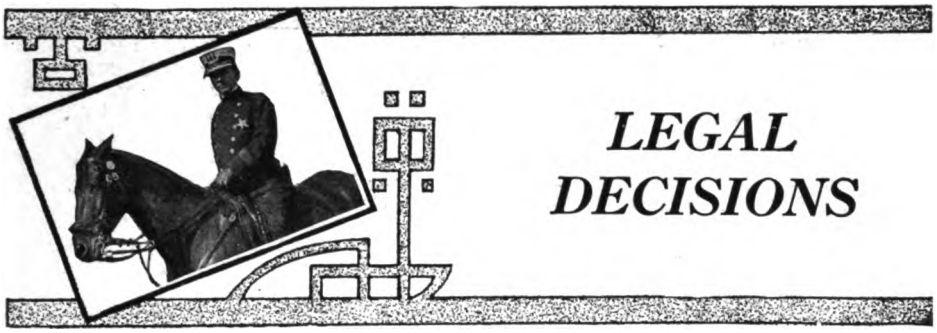

Decisions of the Higher Courts of Interest to Municipalities

City Must Supply Water at Same Rate to All.—A city which constructs, as authorized by statute, a water supply system for its inhabitants and for territory outside the limits, must furnish water to all consumers, whether within or without the city, at the same rate, in the absence of some physical difference justifying a separate classification of those consumers who reside outside the city limits. City of Montgomery v. Green et al. (Ala.), 65 So., 783.

Alley May be Appropriated for Parkway.—Where the state conferred its full powers of eminent domain upon a municipality which power applies to every species of property, except as limited by the state and federal Constitutions, the municipality may condemn a public alleyway for a parkway, for the municipality already owns the public easement, and the private easements of abutting owners are private property subject to condemnation. Chaplin v. Kansas City et al. (Mo.), 168 S. W. 763.

Harrisburg Filters Do Not Infringe Patents.—The Jewell reissue patent, No. 11672, for a filter for municipal or other large waterworks plants, and the Jewell patent, No. 644137, for the method of purifying water by the use of such filters, held not infringed, on uncontradicted evidence that experiments conducted during six months with the alleged infringing filters in use by defendant city, while being operated in the customary manner, failed to show the characteristics claimed to be inseparable from the operation of the patented apparatus and method. filter bed. Sand of "effective size," as used in connection with a filtration plant, means sand containing 10 per cent. by weight that is finer in grain than the diameter sought to be secured. City of Harrisburg (Pa.) v. Continental Jewell Filtration Co., 217 Fed., 366.

Discretion of State Public Service Commission.—Where the public service commission ordered a waterworks company to terminate a contract by which it had agreed to furnish water to certain mills free for forty-nine years, after a hearing of which the mill companies had no notice, and later the mill companies intervened and showed that the contract was executed in consideration of the transfer by the mills to the water company of the water plant, though there was no reservation of the right to use the water in the deed of transfer, it was not abuse of the commission's discretion to set aside the former order directing the termination of the contract. State ex rel. Raymond Light and Water Co. v. Public Service Commission of Washington et al., 145 Pac., 215.

Damages for Change of Established Grade by City.—Where a city by ordinance has established a street and curb grade for both roadway and sidewalk, both the city and adjoining property owners were bound to conform to such grade, and the city after such conformity could not change the grade without payment of damages resulting to the property owners thereby, but abutting owners could not recover damages for the destruction of their old sidewalks so far as they did not conform to the official grade, but were entitled to recover such damages as resulted solely from lowering the side-

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by a city council, does not, ipso facto, work a forfeiture of the works and franchises of the corporation, and it may thereafter collect same charges for supplying water. Hatfield v. Peoples Water Co., (Cal.) 145 Pac., 164.

Liability of Municipality for Overloading Surface Drain Is Limited.—Under St. 1909, c. 269, authorizing a town to construct a drainage system and to maintain subdrains discharging water into any brook, and to deepen, widen, and clear of obstruction any brook, etc., and by sec. 5 made liable for damages therefrom, a town which took and paid for the right to lay and maintain a subdrain thru plaintiff's land to a brook did not thereby make the brook a common drain, and have the right to enter upon private land to clean it of obstructions, and was liable only for causing an overflow of the brook and the flooding of plaintiff's land, and not for damages resulting from an obstruction not caused by the subdrain. Diamond et al. v. Inhabitants of Town of North Attleboro, (Mass.) 107 N. E., 445.

Town Liable for Overflow of Standpipe.—Regarding a town's liability for overflow of its standpipe onto adjacent property, tho the regulation valve, clogging of which occasioned it, was under control of the metropolitan water system, with the conduits of which the town's service pipes were connected, yet it being unquestioned that, if foreign substances in the water passed into the valve, it would cease to work automatically, and leak, flooding the standpipe, and there being evidence that an overflow pipe, which would have prevented the damage, was feasible, the jury could find the town reasonably ought to have anticipated and guarded against the condition. Kelly v. Inhabitants of Town of Winthrop, (Mass.) 107 N. E., 414.

Town Liable for Negligence of Waterworks Employe.—Within the rule that a municipality is liable for negligence in operation of a system of waterworks if it is operated as a commercial venture, it is immaterial that the city may not make a profit, if in its essential nature it was to be operated for a profit, and it could not escape liability for negligence in operation in that it was to get a portion of its supply of water from the metropolitan water system, which was entitled to the immunities of a governmental undertaking. Pearl v. Inhabitants of Town of Revere, (Mass.) 107 N. E., 417.

Water Company Not Required to Supply Beyond Area for Which Intended.—A state commission is without power to order the owner of a water system, constructed and operated only to supply residents on certain lands, to connect such system with other consumers and furnish them with water, where there was no evidence to warrant a finding that the supply of water was more than required to properly serve the consumers for whom it was intended. Van Dyke et al. v. Geary et al., 218 Fed., 111.

Liability for Damages for Grade Crossing Elimination.—Where a municipal corporation changes or regrades its streets, and does so skillfully, without trenching on the property of adjoining owners, it need not pay consequential damages, since abutting owners hold their property subject to the right of the city to make such changes in the grade of the highway as public convenience may require. If it is to eliminate a grade crossing, for convenience of the general public, an abutting owner cannot recover from the city because the change in the grade resulted in the greatest benefit to the railroad company. If the railroad company had nothing to do with the work of changing the grade, it is not liable to an abutting owner, tho it is greatly benefited; but where the city gave its consent to the construction of an approach to a bridge by the railroad company, and the company voluntarily did the work for its own interest, it is liable to an abutting owner in damages, where the approach rendered access to his property by an alleyway more difficult. Baltimore & Ohio Ry. Co. v. Kane et ux.; Mayor and City Council of Baltimore (Md.) v. same, 92 Atl., 532.

Sewage Farm for Ontario, Cal.

The city of Ontario, Cal., has purchased 175 acres of land at $225 an acre on which to discharge its sewage for irrigation and fertilization purposes. The city then leases the farm to E. A. Parkford, from whom it is purchased, at $3,150 a year for 25 years with two years rental in advance, the city to deliver its sewage to the farm without cost to him.

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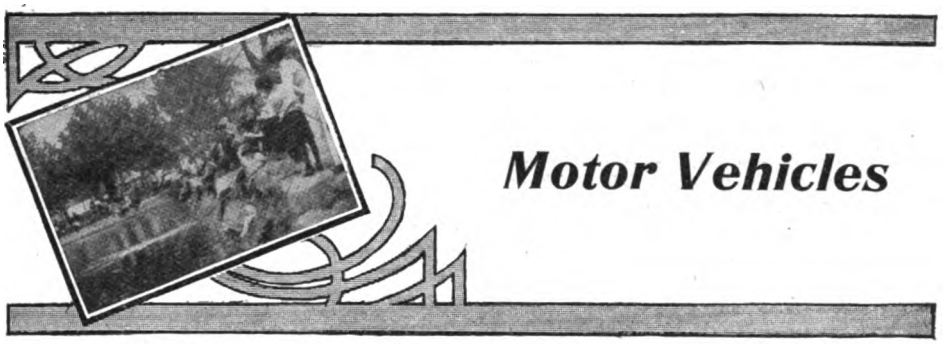

The Motor Truck in Road Building

MOTOR trucks effect a large saving in the cost and reduction of the time in every road-making operation. County commisioners and road contractors are using such trucks in grading, leveling, dragging, surfacing and rolling roads, as well as in hauling, dumping and spreading road material. Gasoline trucks will do all of this work cheaper than it can be done by any other method.

The wide steel wheels of the trucks shown in the photographs enable them to operate on soft, fresh-made surfaces or in pits where snatch-teams would be needed for horses, hauling five tons of material.

A 5-ton truck can pull two of the heaviest graders 40 miles a day and pulls a 16,000-pound drag, covering a road width of 36 feet, 50 miles a day. It also packs and rolls the surface with its broad steel wheels replacing the road roller. It pulls trailers when conditions are suitable and is used to transport gangs, tools and supplies.

In Nuxebee County, Mississippi, the prevailing cost of gravel hauling in road work has been $1.70 per ton, when the haul did not exceed six miles. On this basis a recent job of hauling 448 tons from gravel cars at Brooksville to a road job six miles distant would have cost the county $762.60, and the work would have been extended over a long period. Instead of using mules, however, the board of supervisors used a good roads truck and the work was done in ten days, with a saving of $527.23. The total earning under the contract price would have been 448.65 tons at $1.70 per ton, or $762.70.

The operating expenses included:

376 gallons of gasoline at 19c.....	$71.44
36½gallons of oil.....	13.86
Grease	2.70
Total for fuel.....	$88.00
Negro labor at $1.50-$1.75.....	84.67
Driver	62.50
Total $235.17	

leaving a gross profit of $527.53.

The wages for the driver are given as $62.50 for 10 days, whereas drivers can be obtained for $75.00 per month. The three road commissioners for this district express their belief that the county can build roads cheaper with these trucks than they can be built by letting contracts.

The commissioners of Cabarrus County, North Carolina, made a test in which 26 miles of road were rebuilt in 43¼ hours. At the conclusion of the test, Superintendent of Roads J. M. Bunage made the statement that the work was done better than by any previous method. Three different kinds of roads were worked in this test—clay, sand-clay and macadam. The commissioners first unloaded 80,000 pounds of cement, and the truck hauled this material one-third of a mile over a muddy road, including a 4 per cent. grade. Then, in eight successive days, the truck pulled graders and drags on a stretch of road 26 miles long. Every part of the road was graded, dragged and rolled. The ditches were cleared and remade by pulling thru the ditches once on each side after the original grading and dragging had been done. In rebuilding 26 miles of road, the truck traveled 202.5 miles. The total cost for fuel and oil was $48.93. Only two men were employed, the driver of the truck and the operator of the road machinery.

A record for high speed and economy was made in dirt road construction in Guilford County, North Carolina, where, among other results, 2½ miles of road were built in seven hours. One of the heaviest types of road graders was used to cut a hard top soil road, but the truck had no difficulty in pulling the grader at the desired speed, turning up earth as required by the superintendent.

Mule power was pitted against motor power for nine days in a test in Putnam County, Florida. Eight mules were placed

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FIVE-TON TRUCK *on road work in Cabarrus County, N. C. Convict labor is used. Note the steep hills to the fill at the bottom to reduce the grades.*

in direct competition with a 5-ton truck, pulling graders and three-way drags over a road which had no hard surfacing, but a large proportion of sand. The result of this test showed that the motor truck, on the same expenditure, did five times as much work in the same time as the eight mules, or, in other words, the truck did the same volume of work at one-fifth the cost of using mules. While eight mules graded and dragged 77½ miles in 90 hours, the truck graded and dragged 161 miles, and, in addition, the smooth, broad wheels of the truck rolled 256 miles. If mules had pulled a 5-ton road roller 256 miles, in addition to grading and dragging as much as the truck, it would have required, as shown by the test, 35¾ days, and the cost would have been $536. The cost of doing this work with the motor truck was $101.90, or $11.77 per day.

In the construction of one test road the entire subgrade was plowed soft. With a full load, the truck was run over the subgrade four times and the broad steel wheels rolled the subgrade smooth. Then the gravel was dumped and spread, beginning at the point nearest to the gravel car. As the loads were hauled to the progressive dumping points, the fully loaded truck, driving over gravel that had already been dumped and spread, packed it down thoroly. Thus the dumping and rolling are done simultaneously. The hauling of the gravel cost 7½ cents a yard mile, the average of 32,067 yard miles.

The highest economy in stone road construction has been achieved by the pike commissioners of Polk County, Tennessee, by taking full advantage of the manifold uses of two 5-ton trucks. Stone of three different sizes for sub-grade and surfacing was hauled, dumped, spread and rolled. The hauling and dumping was done in the quickest possible time by reason of the simplicity and speed of the power dumping mechanism. Rapidity in spreading added greatly to the speed and economy of the work. The first grade was very coarse, the second medium and the third practically dust. The automatic dumping and spreading truck was utilized in this method of sorting, loading and applying the stone. After the road has been properly prepared with a grader, the coarse stone is hauled to the job. The power dumping mechanism elevates the body to an angle of 47 degrees, and the driver pulls a lever which trips the tail-gate at the moment the truck starts to move. In this manner the dumping and spreading are automatic, and the material is applied evenly as to width and thickness. This stone is then rolled by the truck. In exactly the same manner a layer of the medium size stone is spread and rolled, after which a layer of stone dust is applied. When sprinkled and rolled the surface becomes smooth, hard and thoroly bound.

Serious problems in road maintenance have been solved by a similar truck in Orleans County, Louisiana, in a striking manner. A hard shell road, leading out of the city of New Orleans, which had been built through a swamp for three miles at a cost of $90,000, became so full of waves and holes, after seven years' use, that a motor car could not be driven faster than twelve miles an hour with any degree of comfort or safety. It was

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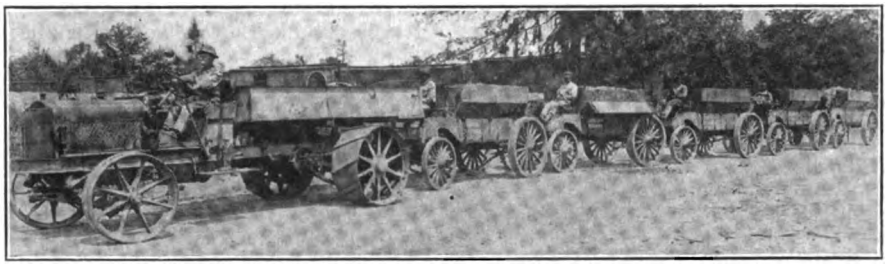


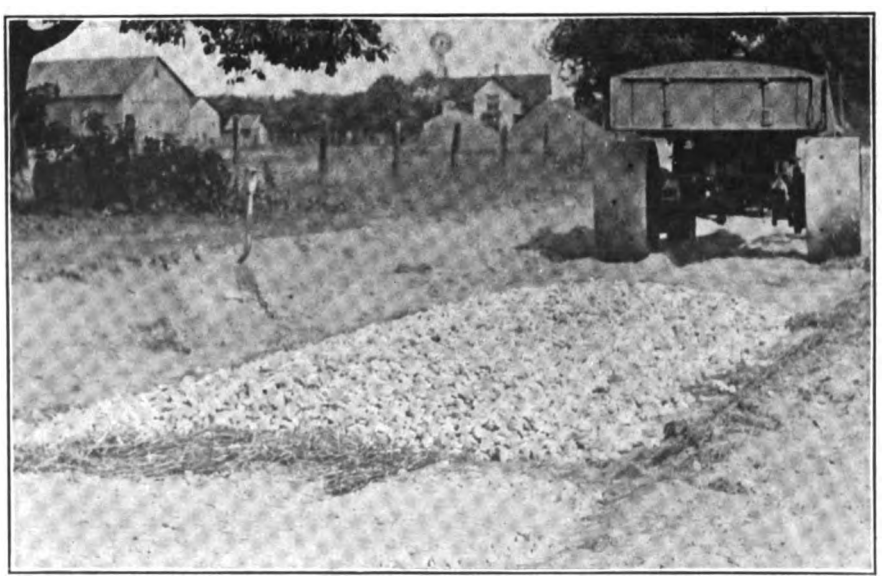
FIVE TRAILERS *hauled by a five-ton truck, all loaded, on road work in Chatham County, Georgia.*

believed that the road would have to be scarified and rebuilt. But, immediately after a soaking rain, a grader was attached to the truck, and, in cutting, the blade of the grader was sunk into the bed of shells, making a furrow four inches deep. After one circuit, cutting and clearing the furrow, the truck made two other trips, moving the loose shells and binding material toward the crown of the road. At the same time the blade of the grader cut off the high spots and filled up the holes. The smooth steel wheels of the truck packed the material thoroly and rolled it smooth. The condition of the binder was such that the material cemented exactly as it was left by the machine. With one day's work the surface of the road was made hard and smooth. Automobiles were driven over it faster than 35 miles an hour with perfect comfort.

When the commissioners of Chatham County, Georgia, used mule teams, it required anywhere from four to six weeks to build one mile of permanent road. With the motor truck and roller-bearing trailers, they build a mile in four days, with a tremendous saving to the county. Fifteen mule teams and a large percentage of the drivers have been eliminated. The Chatham county commissioners conducted a test of 45 days' duration, hauling Augusta gravel, which weighs 2,700 pounds per cubic yard, a distance of 1.15 miles. The truck was tested for 411 hours, and it moved 4,023 tons. This tonnage was handled at the rate of 89.4 tons a day.

Total number of tons	4023.0
Total number of miles	1662.5
Miles per gallon of gasoline	1.5
Miles per gallon of oil	23.0
Total cost of operation	$459.52
Cost per ton	.112
Cost per ton-mile	.10
Cost per yard	.1542
Cost per yard-mile	.134

MOTOR TRUCK *has dumped and automatically spread a load of broken stone on a road at Berrien Springs, Mich.*



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A motor truck hauled shell at 12½ cents a yard in a test in Volusia County, Florida. The truck did the work of 13 double teams, drivers and wagons, the average cost of which is $5.25 per day for each team, driver and wagon. This represents a gross saving of $68.25 per day. In this test the truck hauled periwinkle shell for road surfacing, the length of haul being 1.08 miles, or 2.16 miles per trip. The total amount of material to be moved was 430 tons, or 573 yards, and the truck hauled 53¾ tons per day, completing the work in eight days. The actual running time, however, was only 28 hours. The time consumed in loading and other losses of time totalled 61 hours. The total cost of operation was $71.80 and the cost per yard mile was found to be 11.6 cents.

More Gasoline from Petroleum

Dr. Walter F. Rittman, chemical engineer of the U. S. Bureau of Mines, is announced by Secretary Lane, of the Department of the Interior, as the discoverer of a process for producing gasoline in refining petroleum which will increase the gasoline product 200 per cent. or more. The process will be patented and the patent dedicated to public use. The Standard Oil Company has operated such a process for some time and the free use of the new patent will put other oil producers on a par with the Standard in this particular.

New Motor Fire Apparatus in Boston

According to a recent statement by John Gradey, fire commissioner of Boston, Mass., the department is receiving a large amount of new apparatus. This includes the following:

A new 85-foot aerial truck, motor driven, built by the Seagrave Company, of Columbus, Ohio.

Water tower No. 3, attached to an American and British tractor, which ran over the roads from Providence to Boston.

A Robinson tractor, attached to aerial ladder truck No. 14.

A Robinson tractor for aerial ladder truck No. 15.

Robinson motor pumping engine No. 41 showed its ability to do good work in the worst snow storm of the winter on January 25. On account of second and while there it responded to an alarm, arriving at the fire promptly and helping to extinguish it. The ease of its operation is reported as materially greater than that of horse-drawn apparatus.

The three water towers in the department are equipped with American and British 2-wheel tractors. They weigh about 9½ tons each and they were run over the roads from Providence to Boston, one of them immediately after a heavy snow storm. They have been successfully tested on steep Parker Hill avenue, covered with snow and ice.

A Trackless Trolley Car

The accompanying photograph shows a trackless trolley car in operation in Gmuend, Austria, in winter. This method of propulsion of vehicles seems to be fairly successful, and where roads are good but the traffic is not sufficient to warrant street or interurban railway lines, there should be quite a demand for them. The permanent structure being only the overhead wires and the poles supporting them, these lines are much less expensive than cars running on tracks. They are more expensive to construct than automobile lines, but possibly, if electric current is cheap, the operation charges might be enough less to make up the difference.

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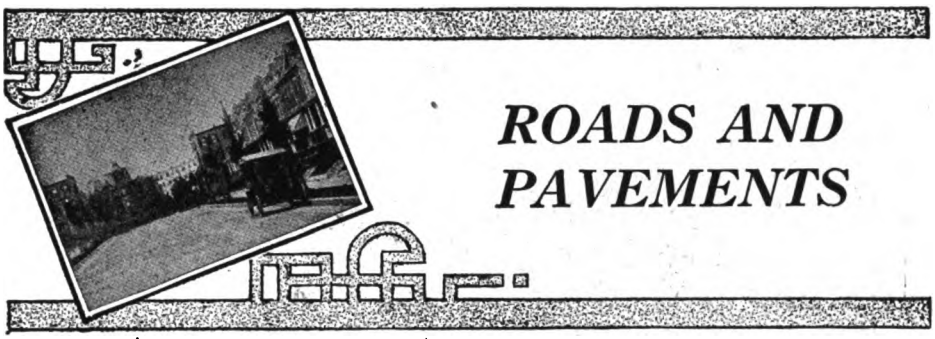

ROADS AND PAVEMENTS

Good Roads Year Book

More than two hundred million dollars of state appropriations have been expended to January 1, 1915, and an approximate total of 31,000 miles of surfaced highways constructed under state supervision since the inauguration of the policy known as "State Aid," according to the Good Roads Year Book for 1915, to be issued in March by the American Highway Association, from its Washington office. Only seven states ,namely, Florida, Georgia, Indiana, Mississippi, South Carolina, Tennessee and Texas, have no form of state highway department whatever, but Georgia grants aid to the counties for road improvement by lending the services of the entire male state convict force. Legislatures now in session are devoting much attention to road legislation and unquestionably several new highway departments will result. North Carolina will probably establish an independent highway department in lieu of the work now done by the state geological survey relating to highways.

New Jersey in 1891 was the pioneer in providing state aid for public highways. Massachusetts and Connecticut adopted the policy shortly after, but only during the past ten years has the state aid policy been in effect on a considerable scale. About 5,000 miles of state highways were completed in 1913 and about 6,000 miles in 1914, so that the past two years have been responsible for more than a third of the entire state highway mileage. The state highways in America now exceed by 6,000 miles the national road system of France.

To have state highway departments placed under non-partisan, efficient control; skilled supervision required in all construction work; a proper classification of highways to insure intelligent distribution of improvements; an adequate provision for maintenance of highways from the day of their completion—these are among the objects for which the American Highway Association is waging a vigorous campaign.

Municipal Terminals for St. Louis

The franchise of the Terminal Railroad Association of St. Louis for the tracks it occupies on the river front expires next December and the city officials are studying the problem of railroad and water terminals with reference to the establishment of municipally-owned and operated facilities for such terminals and the exchange of traffic between land and water vehicles. Several members of the administration have made a trip down the Mississippi river to study the terminals, especially the municipal docks and belt railway at New Orleans, which furnishes what is in many ways an ideal system of interchange of traffic.

Speakers at the River Terminals Conference, held in St. Louis, September 19, advocated modern cranes and lifting devices for transferring freight from car to boat or the reverse, the most expensive operation involved, that the terminals should be owned by the municipalities and that the fees for their use should be the least necessary to pay maintenance and sinking fund charges.

Grade Crossing Elimination in Dallas

The board of city commissioners of Dallas, Texas, has passed orders taking the first steps toward the elimination of many grade crossings in the city in accordance with the only amendment to the city charter adopted out of thirty-four submitted to the voters in January, 1914.

The city attorney has been instructed to notify the railroads to appear and city engineer J. M. Preston has been asked to prepare a report on the results of his investigations of the subject, utilizing to the fullest extent the new union passenger station. Most of the construction promises to be in the shape of viaducts leading the streets over the railroads, tho the park board is working on a subway under the tracks of the M., K. & T. railroad at one crossing.

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An Ornamental Park Bridge

Attractive features in and about the approaches to our cities serve the useful and commendable purpose of creating on the mind of visitors a pleasing impression of the community.

Too often, however, the districts adjoining the railway depots and boat landings are given over to purely utilitarian purposes, and little or no thought given to their ornamentation. Where conditions will at all permit, there are few features more appropriate at the railway station than an open space with drives and foliage, laid out by the landscape gardener. The visitor on emerging from the train is then greeted by welcome foliage and flowers in the summer, and in winter is permitted to have an unobstructed view of the surroundings.

In open spaces of this kind, an ornamental bridge is an interesting feature, contrasting with the foliage and the water beneath it. The one shown in the accompanying illustration is at Madison, N.

financial result of the operations of the city from May 19, 1914, to February 19, 1915, which is very encouraging. He received from the old city council on the former date, $181.94 in the general fund, and now reports a balance of cash in hand of $3,466.27, after paying $8,278.74 of old bills. The total expenses for the period were $24,275.79, including the old bills referred to.

Development of Wire-Cut-Lug Brick

In 1910, the Dunn Wire-Cut-Lug Brick Co. started with one licensee making brick under the Dunn patents, 55,825 square yards of pavement were laid, and 2,233,000 brick were sold. This form of brick has so fully demonstrated its value that on January 1, 1915, there were twenty-six licensees operating forty-two plants, and new plants are added at frequent intervals.

The phenomenal growth in the business

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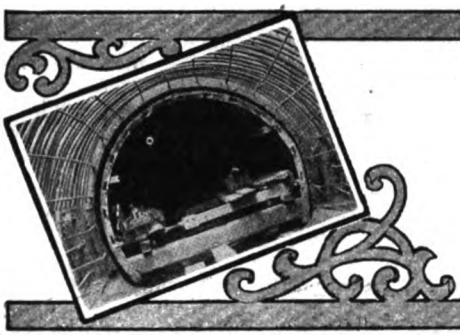

CONCRETE

Fire Resistive Value of Concrete

A committee of the American Concrete Institute, composed of Cass Gilbert, architect, New York, past president American Institute of Architects; E. J. Moore, chief engineer, Turner Construction Co., New York; Walter Cook, consulting architect, Board of Estimate and Apportionment, New York; past president American Institute of Architects; James Knox Taylor, formerly supervising architect, U. S. Treasury Department, Washington; Rudolph P. Miller, formerly superintendent of buildings, Boro of Manhattan; William H. Ham, consulting engineer, Boston; Charles L. Norton, consulting engineer, professor of heat measurements, Massachusetts Institute of Technology, Boston; Richard L. Humphrey, consulting engineer, Philadelphia, past president American Concrete Institute; with Mr. Gilbert as chairman, has made a report on the fire of the Edison plant at West Orange, N. J., from which the following is taken:

"The fire fully demonstrated the advantages of monolithic structures. The fact that at five different places several of the wall columns were rendered useless and yet the upper portions of the building stood intact, is evidence of the superior merits of concrete in monolithic construction.

"Considering the extraordinary conditions surrounding this fire, the behavior of the concrete buildings was highly satisfactory and constitutes an excellent demonstration of the merits of concrete as a fire resisting building material. It is not so surprising that the concrete buildings were damaged as that any material should have so satisfactorily withstood these unusual conditions.

"The end walls in the three upper floors of two buildings extended above the roofs of the adjoining buildings, which were completely destroyed; while this was in the hottest part of the fire, the walls were practically undamaged and are an admirable demonstration of the value of concrete walls as a fire barrier.

"The fused metal found in different parts of reinforced concrete buildings would seem to indicate that the fire reached an intensity of 1000 degrees F. in all these buildings, and in many cases as high as 2000 degrees F.

"In the greatest portion of these buildings the concrete remained firm and hard and intact after this severe heat treatment."

Mr. Edison says that 87 per cent. of the reinforced concrete buildings, which were subjected to very intense heat, are in good condition and about 65 per cent. of the machinery they contain can be used with small repairs.

Construction of Mile Rock Tunnel, San Francisco

There is under construction in San Francisco, a horseshoe shaped sewer 9 by 11 feet. The sewer is being constructed mostly in tunnel, which is approximately 4,380 feet long on 0.1606 grade per 100 feet. The tunnel extends north from Carrillo street under Sutro Heights to its outfall in the Pacific Ocean.

The excavation work and the concrete lining are being handled from two adits, one of which is at right angles to the tunnel and the other making an angle of 20 degrees with the center line. The distance between adits is 3,116 feet.

The work is being carired on from both ends in three shifts of eight hours each, two shifts being devoted to the excavation work and the third shift being devoted to concreting by the compressed air method. The south heading is in hard blue shale, and the north heading is also in blue shale, but has passed thru blue sandstone.

The drilling in the south head is done by two "Little Jap" hand drills and 25 to 30 pounds of 40 per cent. dynamite is used per round. In the north heading, where the rock has been harder, two piston drills mounted on columns have been used and an average of eighteen 6-foot holes drilled, requiring from 50 to 70 pounds of dynamite per round.

As shown in the accompanying photograph timbering is used which consists

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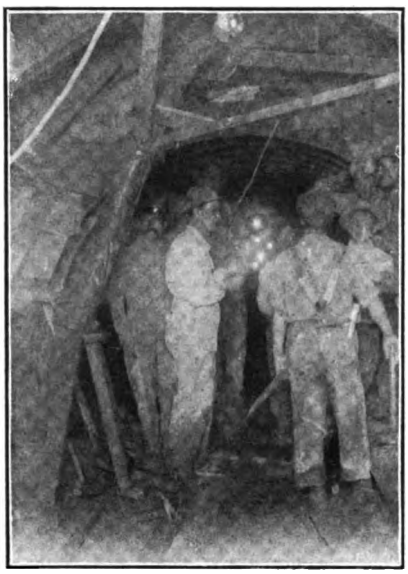


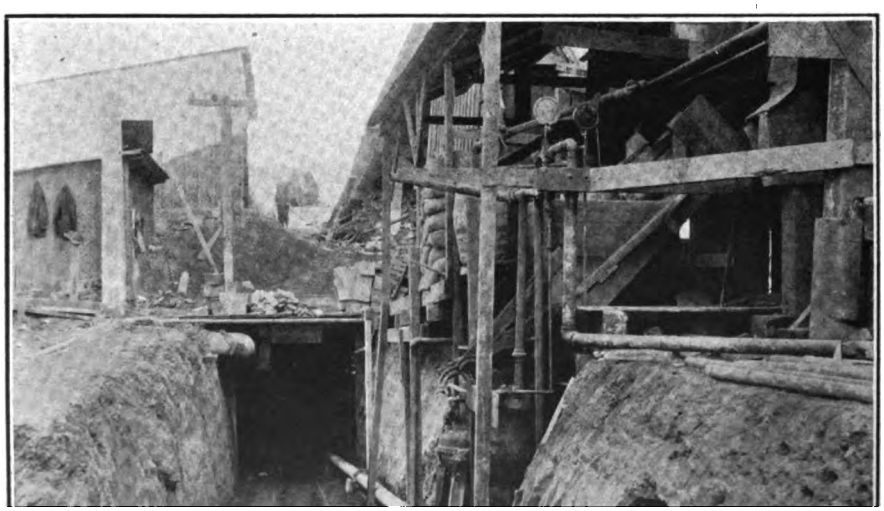
VIEW OF THE INTERIOR *just ahead of the forms showing the concrete pipe as it emerges thru the forms and turns up and back thru the bulk-head, delivering the concrete in place at the crown of the arch.*

CONCRETE MIXER AND CONVEYOR *and loading plant as built at the adit to the tunnel.*

of a two-post five-segment arch of 8 by 8 timbers spaced about five feet centers. Lagging is used only in bad spots.

Mules are used to haul up the muck which is placed in ¾-yard narrow-gage cars and wasted near the mouth of the adits.

The concrete work is following the heading and the compressed air plant used to supply power for the drills is also used for supplying air for mixing, conveying and placing the concrete in the forms. The compressor is an Ingersoll-Rand two-stage machine with a capacity of 1,100 feet of free air per minute with a receiver at the mixing and conveying machine of 120 cubic feet capacity. The mixer and conveyor is placed in a niche at the side of the adit, and receives material by gravity from bins erected over it. The material for each ¼-yard batch is measured in a hopper directly above the machine and is dumped into the machine, together with the proper amount of water for the batch. The machine is then closed at the top by means of a flap door operated by an air cylinder. The machine operator then turns on the air, which enters the machine practically simultaneously above and below the batch and conveys the batch thru the delivery pipe from the machine thru the tunnel into the forms. This pipe passed along the floor of the tunnel thru the forms, where it turns up with a 90-degree bend and back with a 90-degree bend, entering



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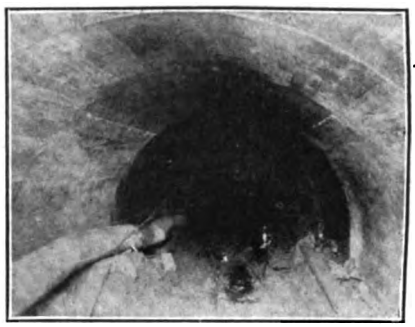
NEARER VIEW OF MIXER *and conveyor. Two men handle all the work at this point.*

the forms at the crown of the arch. A heavy rubber hose about 4 feet long is used on the end of the pipe for distributing concrete. The conveyor pipe is now about 1,300 feet long, but it is intended to extend it to about 2,000 feet. At the present distance about 32 batches of concrete are averaged per hour, but at 600 feet distance the average was about 60 batches per hour.

The finished arch is a very dense concrete, as shown in the accompanying view. The velocity of material projected into the previously placed concrete makes the concrete of great density and also forces the grout against the surface of the forms.

The number of men engaged in the excavation work in each heading consists of one foreman, four miners and six shov- [illegible] The number of men engaged on



SHOWING COMPLETED LINING *and concrete conveyor pipe at lower right hand and ventilating pipe at the left.*

Storrie & Co., of San Francisco. The Pacific Concrete Placing Company, of San Francisco, are the contractors for the concrete work. Pneumatic machines for mixing and conveying concrete are leased by the Concrete Mixing & Placing Company, Chicago. The work was started in August, 1914, and the construction part will cover about one year.

Alien Labor Law Sustained

The New York Court of Appeals has upheld the alien labor law of that state, under which the contractors say that aliens cannot be employed on public work and that contracts for such work will probably rule somewhat higher in that state as a consequence.

Sewage Disposal for Fort Worth

It is estimated by Henry and Gregory, consulting engineers, that complete sewage disposal works for Fort Worth, Texas, including a new main outfall sewer, will cost $782,000. The plant would have a capacity of 12,500,000 gallons a day and would treat the sewage of Fort Worth and Polytechnic and the liquid refuse from the packing houses. Outfall sewer and clarification section of the disposal

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WATER

New Water Supply for Salem, Mass.

After the great fire of June 25, 1914, in Salem, Mass., that city decided to install a high pressure water system and increase the supply by a new reservoir and an auxiliary canal from the Ipswich river. The two projects are to cost about $500,000 and according to Patrick J. Kelley, director of public works, will be completed by January 1, 1916.

At the present time the normal water pressure of Salem is 50 pounds. On June 25, 1914, this fell to 40 pounds and in some instances even lower. Under the new plan the pressure will run from 85 to 90 pounds. This pressure will be obtained by building a new reservoir on Mt. Burnet, which is familiarly known as Folly hill, in the town of Danvers. This hill is four miles from the center of the city. The reservoir on its top will be about 210 feet above sea level, will be of concrete, 400 feet by 150 by 25, and of 10,000,000 gallons capacity.

At Wenham lake will be erected a new pumping station to raise the water from the lake into the new reservoir on Folly hill. In conjunction with the new supply the entire city is to be equipped with iron pipe of larger dimensions than formerly, replacing all the old cement-lined pipe. Already about two-thirds of the city has been equipped.

The estimated cost of the high pressure service is: For reservoir and land damages, $125,000; pumping plant, $75,000; new pipe line, $150,000.

The second proposition regarding the water supply contemplates increasing the amount of water brought into the city by taking excess flowage of the Ipswich river. This involves an expense of $150,000 and as Beverly is interested in the latter project it will bear one-third. In both instances provision has been made for the payment of the costs by bonds maturing in 30 to 40 years.

The present supply and storage basin of both Salem and Beverly is Wenham lake and the present daily average consumption of Salem and Beverly together is about 5,000,000 gallons. The auxiliary supply for Salem and Beverly jointly was authorized by the state legislature in 1913. There is a bill in the legislature now to change the point of intake on the Ipswich river a half mile nearer Wenham lake and save $50,000 in construction. The water will be run thru an open ditch 1½ miles long by gravity to a point 2,300 feet from Wenham lake. Being then 15 feet below the lake level, it will be passed thru a pumphouse, to be installed, and delivered into the lake thru a 2,300-foot concrete culvert. This pump will have a capacity of 2,500,000 gallons a day. Under the state grant the city may pump from December 1 to June 1. The Ipswich river has a watershed of something like 400 square miles and the law insists that it must be allowed to maintain a minimum flow of 20,000,000 gallons a day in pumping season. The excess of normal flowage in fall and spring, however, is large, sometimes in the spring floods the flow being as high as 150,000,000 gallons a day.

Hydro-Electric Light and Power for St. Louis, Mo.

The Union Electric Light & Power Co., of St. Louis, Mo., has filed with the Missouri State Public Service Commission a copy of its ninety-nine-year contract to use the electric current generated at the great dam across the Mississippi river at Keokuk, Iowa. This contract is made with the Electric Company of Missouri, with headquarters at Webster Groves, Mo., which in turn buys the current from the Mississippi River Power Co., which operates it.

The price to the Electric Company of Missouri is said to be about 4½ mills per kilowatt-hour for current delivered at Florissant, Mo., 130 miles from Keokuk.

The latter company carries the lines 10 miles to Wellston at the St. Louis city limits, and transforms it to meet the requirements of the city service. The

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Union Electric Light & Power Co. agrees to pay $687,500 a year for not to exceed 294,771 kilowatt-hours in any one day. This price per kilowatt-hour computed from these figures is not quite 6½ mills a kilowatt-hour as a minimum. For current used in addition, additional price is paid.

An interesting feature of the contract is the provision for adjustment in five years and at ten-year intervals thereafter, the price to be increased at such times one-half of one per cent. for every cent increase in the price of coal per ton in the St. Louis market, so that the cost of electricity will advance as the cost of coal advances, and the increase in price will not depend upon the cost of producing and delivering the electric current.

Des Moines, Iowa, Loses Right to Buy Water Plant.

The city of Des Moines, Iowa, has lost its right to purchase the city works plant, according to an opinion handed down in federal court by Judge Van Valkenburgh. He denied an extension of time for the city to determine the legality of the election for the purchase, issuance of bonds and the like.

The city agreed to pay the water company $2,302,522 on December 3, 1914, for its plant. The city wanted the time extended to May 15, 1915. It is estimated that the city has spent $75,000 in its fight to buy the waterworks plant.

Water Company Offers to Sell to San Francisco

At a regular meeting of the supervisors on February 1 a communication was received from the Spring Valley Water Company offering to sell to the city its properties desired for supplying water to the municipality for the sum of $34,500,000. This offer is the same as that submitted to the advisory water committee and was in response to a resolution of the supervisors soliciting such offer and as required by the provisions of the charter. It is now in order for the supervisors to take further proceedings to submit the question of the purchase to the voters.

Improvements of Garrett, Ind.

The city of Garrett, Ind., has a population of about 5,000 and is making some notable improvements. In June, 1914, the new city hall was occupied. It is 50 feet wide and 125 feet long, two stories, with a high basement. The building is successfully heated with exhaust steam from the city water and electric light plant, which is 1,700 feet distant. The city had a municipal Christmas tree in the street in front of the city hall with a program prepared by the Garrett Municipal Yuletide Association, with a speech by the mayor, songs and distribution of gifts before and after.

In 1914 the expenditures for city purposes were practically $50,000, and the balance in the treasury was increased about $1,000. The city has $123,000 worth of property, including $34,500 for city hall and lot, $30,000 for water mains, hydrants, etc., $6,000 for steam heat pipe line, $8,500 for electric light plant, poles and lines, $3,500 for ornamental street lights, and many smaller items. The liabilities on this property are $8,000 water bonds, about $21,000 on city hall accounts and a few small items, making a total of $31,137.12.

In 1915 it is proposed to construct a trunk sewer to the city drain at a cost of $8,000; to install a new engine and accessories in the water and light plant, costing $5,500; to spend $500 in rebuilding electric light lines in the eastern part of the city, and to spend $2,000 in decorating and placing some tile and terrazzo floors in the city hall. The sewer cost will be assessed on the property benefited.

The water and light plant did a total business of $23,789.87, as shown by the clerk's collections. The number of electric current consumers increased from 715 to 790 and of water consumers from 815 to 850. The expenditures were $21,186.53, of which $1,061.94 was spent for additions to water lines, so that the profit on operations for the year was $3,789.01, not including $3,757.84 received from taxes, which may represent the city's share of the cost of operating the plant, so that the total gross profit of the plant was $7,546.85. This would pay, say 10 per cent. interest and sinking fund charges on a plant cost of $75,000, which is at least 40 per cent. more than the valuation of all parts of the plant in the schedule of the city's assets. The plant actually paid the city $3,000, besides making the investment of about $1,000 in new construction, and still has a balance in its treasury of $3,209.63 as against an overdraft the year before of $151.55.

The plant may, therefore, be classed among the successful plants and is justified by its balance and the increase in its business in making the proposed enlargements.

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Greatest Drainage Pumps in Operation in Louisiana

On Saturday, February 13, the greatest drainage pumps in the world were started at New Orleans, La., signifying the beginning of a new era in North American conservation and a definite step in the plan of the State of Louisiana to bring into use some 10,000,000 acres of alluvial lands for the purposes of agriculture. They discharge 1,000,000 gallons of water a minute, and in three days' time completely drain an area of 40,000 acres. New Orleans lies on both banks of the Mississippi river. This land is situated on the great peninsula formed by the curvature of the Mississippi, and part of it is the city of New Orleans itself, the remainder being in the parishes of Jefferson and Plaquemine. These are part of the 10,000,000 acres of Louisiana lands which are being reclaimed by the simple process of pumping.

Holland, after seventy-five years of labor and expenditure of $3,200,000, drained 40,000 acres. Construction of the drainage plant opposite New Orleans has been under way for less than a year. The total cost will be $234,000, and it will require only three days to draw off the water and increase the value of land from $100 per acre to a minimum of $300 per acre. Coincidentally, the mosquitoes will perish and human health and comfort will increase.

This work, comparable in its potentiality to the digging of the Panama canal, is the work of one man, George A. Hero, a wealthy citizen of New Orleans, who placed his name and credit behind the task.

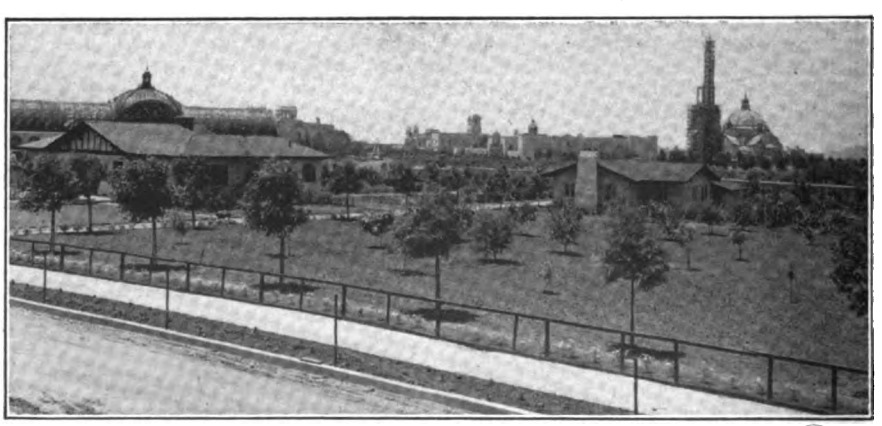
Under intelligent laws, framed for such purposes, a drainage district was created and the land-owners voted a tax against themselves of 75 cents an acre a year for forty years. Drainage bonds, backed by the credit of the State of Louisiana, and further backed by the privilege on the land itself, were issued and disposed of at once.

Other intelligent laws were enacted to aid this and other economic projects in Louisiana. Money invested in land mortgages is free from taxation, also is money on hand, in banks or homestead associations. To-day these fundamental laws of Louisiana have prepared the way for great economic changes. One of these is the huge new cotton warehouse system, owned by the public. This is part of the dock and wharf system, which is likewise owned by the public. This great warehouse system will have facilities for accommodating and handling 4,000,000 bales of cotton, or practically one-third of the entire crop of the South.

San Diego Exposition's Model Farm

The accompanying photograph shows a part of the model farm which forms a part of the Panama-California exhibition at San Diego. The five-acre tract contains trees which bear peach and apricot and loquat and walnut and cherry and pear, and beneath the boughs are a thousand rows of vegetables, filling every foot of soil and leaving no space wasted; the whole surface is irrigated and farmed scientifically, and the tract under such treatment is bearing more than an area four or five times as large under old-style treatment. There is a small poultry ranch at the rear, a little vineyard, a berry patch. In the center of the farm is a model bungalow, at which the wife of the prospective farmer may look, and see that, while machinery is saving her husband the drudgery of the farmer's life of three or four decades ago, so machinery is saving her the drudgery which was the lot of that earlier farmer's wife. She will see that in leaving the city apartment she is not abandoning modern comforts.

We are indebted to the Seagrave Company, who furnish the fire protection for the exposition, for the photograph, which is copyrighted by the exposition company.



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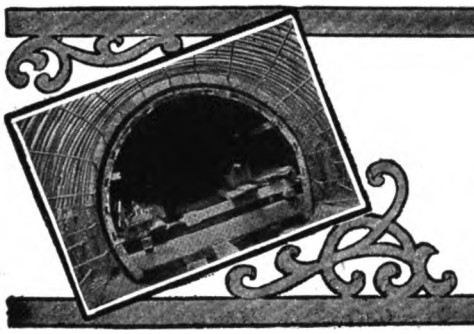

SANITATION

Sewage Disposal at Lethbridge, Alberta

The new sewage treatment plant at Lethbridge, Alberta, is described in a paper before the Canadian Society of Civil Engineers, by A. C. D. Blanchard, who was city engineer at the time the plant was built, on plans of T. Aird Murray, consulting engineer, which were somewhat modified by Mr. Blanchard. The following notes are taken from this paper:

The city of Lethbridge is situated on a level plateau about 250 feet above the Belly river. Its first waterworks system was built in 1904. At the present time the population is about 12,000. With the extension of sanitary sewers the volume of sewage is rapidly increasing. The water pumped averages 1,300,000 gallons per day, and the waste returned to the disposal works is in the vicinity of 1,000,000 gallons per day. The city has a separate sewerage system, and three converging outlets bring all the sewage to the site of the works by gravity.

In the design of the sedimentation tanks there was sufficient novelty to evoke considerable discussion at the meeting of the Dominion Health Commission in Montreal in 1911, and as a consequence, some details of the design were altered, but the general type remained the same. The particular type of tank installed has been known as the "Lethbridge" tank. There is nothing unusual in the design of other parts of the plant, which is intended to treat the sewage of the city by preliminary screening, sedimentation, sprinkling filters and a further passage thru small sedimentation tanks. The liquid thus purified is passed thru a narrow baffle-race where chlorine solution may be applied.

The detritus tanks which contain the screens are in duplicate and have hopper bottoms, each equipped with a sludge valve. The screens do not reach to the bottom of the chambers. They are of ½-inch wrought iron with ½-inch openings. After passing thru the screens, the liquid passes over a weir into a collecting channel, and is then distributed thru two 18-inch pipes controlled by penstocks into the distributing channels of each sedimentation tank. The sludge or detritus in the compartment of the detritus chambers is intended to be disposed of thru sludge pipes discharged by gravity into one of the sludge beds. Each detritus tank, in volume, contains 675 cubic feet. The liquid surface area is 120 square feet and the area of the screen, including openings, is 52 square feet.

The sedimentation tanks are in duplicate. They are covered with a concrete roof 6 inches thick, supported by 24-inch I-beams, excepting over channels, which are covered with removable creosoted planks. Thruout the length of each are two distributing weirs. The one first reached by the liquid is on a slope of about 2 inches in the length of 100 feet, and the second weir is level. This latter weir is intended to equalize the flow so that the velocity of the liquid across any portion of the tank will be uniform, thereby causing the minimum of disturbance during settlement. Before reaching the collecting weir, the sewage is baffled by a 6-inch concrete wall with 4-inch holes near the bottom of it at intervals of 3 feet. The liquid passes thru these apertures into the collecting channel over the weir. This channel averages 15 inches in depth, there being a bottom slope of 6 inches from end to end. The particles capable of settling during the period of flow in the tank are deposited on slopes of wire glass, and when they have accumulated in sufficient mass the solids slide down the slopes and under the glass apron into the sludge compartment. This apron is a distinctive feature of the Lethbridge tank, and consists of ¼-inch wire glass laid on 4-inch I-beams spaced 5 feet on centers. The apron has a slope of 1 foot in 3.3 feet, and completely covers the sludge chamber. The corresponding fore-slope at the collecting side of the tank is formed in concrete on solid foundations, in which the wire glass is imbedded to form a smooth surface. The

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slope of this portion is the same as that of the apron. Each tank is one hundred feet long and thirty-two feet wide. The period of flow for maximum capacity is practically two and one-half hours, and the maximum average velocity of flow is at a rate of .037 foot per second. The total contents and measurements of the various compartments are as follows:

(a) Total capacity.....34,000 cu. ft.
(b) Sludge capacity.....10,133 cu. ft.
(c) Capacity above apron..16,475 cu. ft.
(d) Capacity between sludge line and apron ..... 8,000 cu. ft.
(e) Liquid surface area... 3,200 cu. ft.

Note.—Sludge capacity is taken up to toe of fore-slope.

The capacity of the sludge compartments of both tanks amounts to 20,266 cubic feet. Storage is provided for a period of three and one-half months, based on a separation of 3½ cubic yards of liquid sludge to each million gallons of sewage. Each compartment has four hopper-shaped bottoms, a separate sludge valve being provided at the junction of the four slopes in each bottom. Two slopes of each hopper have a pitch of one in three, these variations being caused on account of the fact that the hoppers are not square. The top of the sludge compartment is, of course, formed by the glass apron previously mentioned, and this apron has sufficient pitch to allow gases which collect on the under side to pass to the extreme upper part of the apron, from which they are removed thru small galvanized iron pipes. In addition there are two 9-inch vitrified pipes at the ends of each tank which also serve as outlets. The sludge valves open on a 6-inch cast iron pipe line running lengthwise with each tank, and after these pipes are carried beyond the wall of the tanks they meet a 9-inch pipe line leading from the detritus tank sludge chamber directly to the sludge beds. The stems operating the sludge valve extend thru the glass apron to the roof and are exposed for use by removing small cast iron covers set in the concrete roof. One-inch water services direct from the city force main are connected to the end of each line of sludge pipes for the purpose of flushing, if desired.

The liquid passes thru to either of the filters by means of 12-inch cast iron pipes laid along the bottom of the filter floors to the riser pipes at the centers of the filters. The filter apparatus is of the standard rotating "Cresset" type. The sprinkling arms cover a circle, having a diameter of 108 feet, and are probably the largest yet installed in this country.

The filters are three in number with concrete floors and have their surfaces exposed to the weather. They are placed in juxtaposition so that the circular walls surrounding them do not meet at the point of contact of each filter. The walls are of concrete, and the filters are built on the natural soil, except at one place, where it was found that the ground was not sufficiently high to carry the floor. At this point the outside walls were carried down to the proper foundation, and the space between the ground level and the under side of the concrete floor was filled with gravel, the maximum fill being in the vicinity of 2 feet. The medium is composed of a mixture of broken brick, hard furnace slag and gravel, the average diameter of the particles being about 2½ to 3 inches. Near the bottom of the filters the slag was put in, in large pieces, to protect the 4-inch collecting pipes of vitrified and field tile, which have ¼-inch open joints, and also to permit the quick flow of the liquid along the bottom. The central arm or standard carrying the revolving arms was surrounded by a pigeonholed brick wall, about 4 feet away from the drum. This construction was not only for the purpose of inspecting the machinery, but also to provide ample aeration for the filter beds themselves. The slope of the floor is 6 inches in a distance of 54 feet. The total medium area of all three filters is 0.62 acre, the average depth of medium, 7′ 0″, and the minimum capacity of the sprinklers is one-fifth of maximum, or 133,300 gallons to each distributer.

The humus tanks, for the purpose of obtaining further settling of the partially purified liquid after passing thru the filters, are constructed in duplicate, and are built adjacent to the filters, and at a depth sufficient to provide a good fall from the central collecting channel of each filter to the distributing channels of

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drawn off from the tanks into the collecting channel over weirs 12 inches wide, and it then passes into a baffle race at the upper end of which is inset a pipe leading to the float chamber in the chlorinating house. There is also to be installed a small pipe carrying the hypochlorite solution.

Measurements of each humus tank are as follows:

(a) Capacity	4,120 cu. ft.
(b) Liquid surface area	1,200 sq. ft.
(c) Length of influent and effluent weirs	80 ft.
(d) Distance apart of influent and effluent weirs.	15 ft.
(e) Difference in elevation of influent and effluent weirs	.1 ft.

The design of the chlorinating plant is so arranged that there is an automatic regulation of the flow of chlorine solution into the liquid. This is done by the rise and fall of the float in the float chamber, which operates a lever, which in turn regulates the supply. Thus, if the volume of liquid coming thru the humus tank is increased, the level rises in the baffle-race, causing a consequent increase of chlorine solution to be applied. The baffle-race is only intended to give a thoro mixing of the chlorine solution before the liquid is discharged into the main outfall sewer, which carries the finally purified effluent to the river at a distance of about 1,000 feet.

The sludge beds are in duplicate and are simply rectangular excavations in the soil. It was not found necessary when the plant was constructed to do anything towards putting in a gravel or broken stone bottom to these beds, as there are strata of gravel in the excavation which carried away moisture from the deposited sludge in a most effectual manner. This was taken advantage of in the construction of the sludge beds. A narrow roadway at the end of each bed gives access for carts for removing the dried humus. Each bed has a surface area of 480 square feet.

Operation of the plant was commenced in the month of October, 1912, and the apparatus was given a fair trial before heavy frosts set in. Some difficulty was encountered in obtaining a proper seal in the drums of the rotating filters, and it required a considerable length of time to find out the exact cause of the defect. After careful examination it was found that the upper portion of the drum had developed a very small leak which allowed the air gradually to escape, with an ultimate loss of the seal. This was easily repaired and continuous running of the filter units was then possible.

After a month or two, however, it was noticed that a very considerable amount of colloidal matter was accumulating in the revolving arms of the filters, and it was found necessary to employ a man for a large portion of the day to keep the small holes in the filter arms from choking. After several endeavors to find the cause of this trouble, it was observed that when the accumulation in the detritus tank increased the accumulation in the filter arms became more objectionable. Since no adequate means were provided for removing the detritus from the bottom of the tanks, it was decided to flush the accumulating sludge out into one of the sludge beds. This process was then adopted at regular intervals. It appeared, however, that if the detritus tanks were sufficiently shallow to cause practically all the matter which would not pass thru the screens to go over into the sedimentation tanks and there be deposited as sludge, the liquid reaching the tanks would be more uniform in consistency, and the process of treatment improved. An alteration of the shape of the chambers was then considered, providing for the filling up of the lower portion of the detritus tanks with stone or gravel, and the building in of a concrete floor, the screens being sloped sufficiently to give the proper area for the capacity of the plant. By doing this it was hoped that the difficulty in connection with the clogging of the filter arms would be obviated, and the nuisance caused by the flushing of the fresh sludge into the sludge beds eliminated. The particular design adopted for the detritus chamber was felt to be the most troublesome feature of the plant.

After the plant had been operating for a month or two, severe frosts were experienced, which caused considerable ice to form on the top of the exposed filter beds, and on one occasion, after a snow fall of some 6 or 8 inches, one of the filters was started up with the expectation that the warm sewage would melt the snow. Unfortunately, however, the weather suddenly became colder, and instead of the snow disappearing, it was changed into ice, and it was found impossible to get rid of this accumulation until it was removed entirely from the filters. This was the only time that there was any trouble with the revolving arms on account of the accumulations, and it should never recur, as the operator has had the benefit of past experience. Thruout the winter months ice appeared on the surface of the filter beds during cold weather, and gradually built up into circular ridges between which were narrow openings, these openings, of course, appearing directly in the line of spray from the filter arms. No attempt was made to measure the efficiency of the beds under such conditions,

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but it is hoped that a proper laboratory will soon be installed with a chemist in charge, and analyses made of the effluent not only from the filters, but also after passing thru all stages of purification. After running the plant thruout the winter months, it was found possible to obtain continuous operation of the filters with their machinery and surfaces exposed to the weather. In the following summer it was established that the fly nuisance was not a serious factor in so isolated a position. The construction of costly roofs over the filter units was therefore abandoned, altho provision had been made in the design of the filter machinery for the support of roof trusses from the central posts.

The filters are all thrown into use by the opening of penstocks by hand, which would appear to be a better arrangement than automatic control, for the reason that the winter conditions are sufficiently severe to cause freezing in the drums of filters which might be thrown out of commission for any length of time unless these were drained. Every time a filter is shut down, therefore, the operator proceeds to drain out the drum forming the air seal.

The difference in level between the surface of the liquid in the sedimentation tanks and the top of the riser at the center of each filter gave considerable trouble when a large volume of sewage was delivered to the plant. There was a noticeable surge in the distributing chamber at the entrance to the filters, and frequently the top of the riser would overflow, thus discharging unfiltered sewage into the humus tanks. It was deemed advisable to make an overflow from the distributing chamber, and this was accomplished by cutting thru one of the walls of the chamber and inserting a 12-inch pipe delivering into a trough laid on the top of the filter medium between filters Nos. 1 and 2 at a place not reached by the distributing arms. This arrangement seems to give satisfaction, and once or twice each day there is a surge which is efficiently taken care of in this way.

Garbage Disposal for North Yakima.

The health officer of North Yakima, Wash., Thomas Tetreau, recently made a report on garbage disposal by the sanitary fill system which follows. The city has some 2,000 loads of garbage a month to dispose of and about one-third the quantity of ashes:

The constant burning of garbage at the dump gives rise to many complaints from persons who are seriously inconvenienced by the decidedly unpleasant odors to which this burning gives rise. It has, therefore, been decided to try the "sanitary fill" system. The so-called sanitary fill was first tried in Seattle during 1913, and has been found there to be a most satisfactory and economical method of garbage disposal. Waste products of all kinds, including table refuse and other household waste, such as old clothing, mattresses, shoes, rubbers, bottles, tin cans, etc., are thoroly mixed and deposited in low, damp places, in layers approximately three feet deep; if desirable, these deposits may then be covered by a few inches of gravel, crushed rock, cinders, clinkers, or like coarse material. It is found that in these deposits all organic matter is rapidly oxidized without giving rise to any noxious odors.

Oxidation of tin cans and other metal wastes also takes place, tho considerably more slowly than does the oxidation of organic, particularly vegetable, waste. The oxidation is found to be due in part to the direct action of bacteria upon organic matters, which action is greatly facilitated by the porous nature of the deposit, which permits of the absorption of moisture and the escape of the gases formed during the process of decay.

There can be no objection to this method of garbage disposal during the winter months, altho in the summer time it might become necessary to use some insecticide or larvacide, should the dump be found to attract flies.

Your health officer was much impressed with the success of this form of garbage disposal in Seattle, where he recently visited several such fills. Should it be found practical for all seasons in this climate it would probably for a long time do away with the necessity of constructing an incinerator and prove a considerable saving to the city.

Combined Street Sprinkler and Sweeper

Ed. Smith, street commissioner of Huntington, Ind., has just completed a new sprinkler which will be used in combination with the street sweeper wagon. Formerly a sprinkling wagon and a sweeper wagon were both used on the streets. The new arrangement does away with one wagon, team and man, amounting to $4 a day, besides the amount of water saved, at least one-third of the water generally used.

A large tank, which holds 370 gallons of water, was placed on the sweeper. The tank is made of 20-gage galvanized iron. The sweeper lever is placed on one side of the wagon to allow the sprinkler pipe from the tank to be installed. The pipe is placed just back of the front wheels of the wagon. This gives the water about five feet space ahead of the sweeper.

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Municipal Notes

Traffic Regulation by Zones Marked on Pavements

The regulation of street traffic has been greatly aided in a number of American cities by the use of marked zones upon the pavements. One detail alone has obstructed the wider and more satisfactory use of the system. Paving brick offers the solution to this perplexing detail.

In both Detroit and Dayton this method of regulating street traffic has proved very successful.

No satisfactory method for marking zones has yet been developed among the police officials who have experimented with the zone idea. They have searched arduously for a white paint durable enough to stand a reasonable amount of street wear when applied to the surface of a pavement. Constant repainting of the pavements at considerable expense has been an accompaniment of traffic zone experiments wherever tried.

The use of anything so impermanent as paint on the surface of a public highway, of course, manifests the experimental nature of the present traffic zone era. When such means of regulating traffic have become standarized and wholly accepted, permanent markings will be needed.

Brick paving offers the best possible medium for such permanent marking. By laying lines of light brick against a dark brick background, or vice versa, lines can be established which will be visible for half a century if left alone, or can be altered at trifling cost to conform with changes in regulations.

The object of the traffic zone system, so far, has been to keep the different currents of street traffic apart, particularly to indicate spaces within which the right and safety of the pedestrian must be respected. Street crossings are outlined with a 10-foot margin back of which vehicles must remain until signalled to proceed by the traffic officer.

Zones are also marked at points in the street where pedestrians enter and leave cars. The lines here inclose a space perhaps 10 by 30 feet in area parallel to the car tracks. Within this space the passenger can wait for the approaching car with a feeling of security that is impossible when the auto driver is not accustomed, by some visible sign, to steer clear of such spaces.

The problem of auto storage in business centers offers another function for marking. Detroit has set aside a portion of a wide downtown plaza as a place for the parking of vehicles. Markings keep the machines in a straight line and indicate how much space each vehicle may use.

St. Louis has made attempts on several streets to establish an exclusive, one-way traffic compensated by a return traffic on a parallel street. This leaves one side of the street for parking vehicles, spaces being marked at right angles to the curb.

In the same city there is attempt to divide auto traffic at street intersections, so that vehicles turning to the right will keep to the curb. while those going forward or to the left will steer near the center line of the street.

The time is probably at hand when travelers at congested crossings will find their way plainly indicated for them by traffic markings. The mosaic effects possible with varying shades of brick offer a method of marking that should be wholly satisfactory.

Improvements in Arkansas City

During 1914 the city of Arkansas City, Kan., laid 6,663 linear feet of concrete sidewalk, 4,665 feet of curb, and 2,200 feet of curb and gutter, also 19,537 square yards of paving. A handsome concrete bridge, costing $24,000, across the Arkansas river northwest of the city, is practically completed.

The city now has 23 blocks of asphalt pavement, 8.5 miles of water bound macadam, 6 blocks of brick, 1 block of concrete and 41 miles of sidewalks. The water system has 30 miles of mains and 243 hydrants. Rates are 10 to 25 cents per 1.000 gallons.

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A Profitable Light and Water Plant

The Water, Electric, Gas and Power Commissioners of Austin, Minn., operate a combined electric light and power and water supply plant which seems to be financially successful as shown by the annual statements. which are clear and full as is now required by State Public Service Commissions.

The value of the plant is given by subtracting from the valuation at the end of the preceding year depreciation of 5 per cent. and adding the improvemnets of the year. In the last fiscal year this value increased about $13,000 and is $256,115.25.

Including stock, $14,980 of cash and loan of $4,000 to the city, the total assets are $281,699.34, against which are $30,000 of water works bonds outstanding.

During the year the gross receipts were $69,235.91. Operating expenses amounted to $31,727.66, leaving a comfortable balance after ample allowances are made for interest, taxes and depreciation or sinking fund. The interest and taxes actually paid amounted to $2,138.06.

The business is growing, as shown by a net increase in light users of 201, making 1,408; power users of 3, making 66, and 154 water users, making 1,236. Uncollected accounts amounted to only $95.39.

Proper Terms for Highway Bonds

The United States Office of Public Roads has made some studies of the durability of various parts of a highway as a basis of opinion upon the propriety of bonding the state, county or township and upon the terms for which the bonds should be issued. These studies covered 244 roads of gravel, waterbound macadam and bituminous macadam.

For some reason the gravel road is assumed to be 20 feet wide, tho it is more common, especially where gravel is used as the material for the cheaper roads, to make the graveled surface as narrow as the traffic will stand, and the width is usually not greater than 12 feet, and is probably nearer 10 feet. Sometimes the grading is as wide as 20 feet, but even this width is usually not more than 14 to 16 feet. The cost of gravel roads, given as $4,416, is therefore greater than the actual cost, and $2,208 is probably nearer the usual average cost. Probably the proportionate costs of the more or less permanent drainage and grading, 41.15 per cent. of the total cost, and of the quite temporary surfacing, 58.85 per cent., are about the same for the 10-foot width as for the 20-foot width given in the report referred to. The 59 per cent. represented by the gravel can hardly be the basis of a bond issue of more than 5 years' term unless the road is one of very little travel. Probably most of the 41 per cent. for drainage and grading is permanent enough to warrant the issue of 20-year bonds, tho ditches and often bridges and culverts are not built with this degree of permanency, and often not more than 20 per cent. can be considered as having a life of 20 years or more, the remainder averaging perhaps 10 years' life.

The ordinary waterbound macadam is assumed in the report to be 15 feet wide, again somewhat wide except for the modern high-class roads built by state highway commissions. The average cost is given as $9,215, of which 36.89 per cent. covers the cost of the more permanent portions, drainage and grading, and 63.11 per cent. the less permanent surfacing.

For bituminous macadam 15 feet wide the report gives $10,298 as the cost, of which 26.85 per cent. is the proportion expended in grading and drainage and 73.15 per cent. that of the surfacing.

The actual cost of grading and drainage, computed from the above figures, is $3,399 for waterbound macadam and $2,765 for bituminous macadam. As there is no reason for the latter cost being less than the former if the roads are fully constructed, it is probable that this difference arises because the bituminous macadam road is usually a reconstructed macadam or gravel road, on which much of the drainage and grading has been done prior to the construction of the bituminous macadam road. The same seems to be true also of the drainage and grading of the macadam road as compared with the gravel road.

Only a very small percentage of the cost of the kinds of roads above considered can be used as the basis of 50-year bonds; less than 40 per cent., probably as little as 25 per cent., can be used as the basis of 20-year bonds, and the remainder, 60 per cent. or more, could not be used as an ordinary business basis for more than 5-year bonds, and the amount should be divided into equal parts of 1, 2, 3, 4 and 5 year bonds if they are to represent any actual material on the ground.

If the roads are well taken care of and the material worn off is replaced each year as a maintenance charge, there may be some argument for longer term bonds for the portion of the cost representing the wearing surface, but a reconstruction of the surface must be made within 5 to 10 years if the traffic is appreciable, and the portion of the bonds representing the surface should not have life enough to last over the time for reconstruction.

Otherwise the road will not be paid for before it is worn out and the taxpayer will be paying for two roads at the same time covering the same area.

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Advertising Newark

The city of Newark, N. J., has been constructing a system of municipal locks and now has in their vicinity factory sites bordering the best equipped water-rail terminal on the Atlantic coast, according to the attractive circulars of the Department of Docks and Meadows, which show the advantageous location of the docks and the factory sites for direct service to factories and to railroads. Newark is styled the new Atlantic seaport. The department will give full information at its office in the Newark city hall.

San Francisco's First Municipal Tunnel

The Stockton street tunnel has been completed, accepted and was dedicated to the use of the public by appropriate ceremonies late in December. The cars of the Municipal Railway commenced operating thru the tunnel on December 29.

The project for a tunnel in Stockton street from Bush to Sacramento streets was first broached shortly after the fire, and a franchise was granted in 1907 to a private corporation to construct a street railway thru the hill from Market street to the North Beach waterfront. The project proved too great for private financing and the franchise was abandoned in favor of a municipal undertaking.

A large amount of preliminary work had to be done before a start could be made. The charter was amended in 1910 so that the city could have legal authority to undertake the project, and following the adoption of the amendment an ordinance had to be prepared so that the procedure would be adequate for its successful financing. The method called for an assessment of the entire cost upon an assessment district which would be benefited by the proposed construction. There were no precedents for such work in the state, and an original scheme had to be worked out in its minutest detail. The "Tunnel Procedure Ordinance" was framed and adopted in September, 1911, and the engineering department immediately took up the practical part of the work.

The report of the engineer, showing the assessment district, the plans and specifications, and the amount of individual assessments, was filed April 19, 1912. The estimated cost, including possible damages and incidentals, was $631,879. This amount was assessed against 1,443 parcels of lands extending from the south side of Market street to the bay shore on the north. A year was spent in public hearings and in making minor corrections in the details. An action at law, involving the legality of the proceedings, was commenced and resulted in establishing the validity of all that had thus far been done. Damage claims had been settled amounting to nearly $200,000, and bids for construction were received in April, 1913. Actual construction commenced in the month following.

The Stockton street tunnel, as constructed, has the widest arch span of any long tunnel yet designed. It opens a direct line for street car and vehicular traffic between the downtown district and the Panama-Pacific Exposition grounds, and will greatly aid the rapid development of the North Beach territory.

The following data concerning the tunnel are furnished by the city engineer:

Tunnel extends from Bush street to point 182 feet south of the center line of Stockton street.

Length, portal to portal, feet	911
Length of north approach, feet	138
Length of south approach, feet	275
Total length, including aproaches	1,324
Height of arch above curb, feet	18
Width, feet	50
Thickness of base, feet	8
Thickness of roof	2 ft. 8 in.
Cubic yards excavation	143,000
Cubic yards concrete	16,500
Pounds of steel	637,000
Price	$430,000.00
Damages	$191,000.00

Connection of Rival Local and Toll Telephones Required

The Railroad Commission of Wisconsin requires physical connection of telephone exchanges so that local and long distance calls on one system can be made on subscribers on the other system. The Rock County and Wisconsin Telephone companies in Janesville were recently required to make such physical connections between their toll lines and between their local systems in Janesville, including rural service, the expense to be paid equally by the two companies.

Portland Cement in 1914

For the first time since the manufacture of portland cement became a real business proposition in this country there has been a less production in a year than in the year before, the production in 1914 being 88.514,000 barrels, as compared with 92,097,131 barrels in 1913, a reduction of nearly 4 per cent. The production of iron ore in 1914 was about 33 per cent. less than in 1913.

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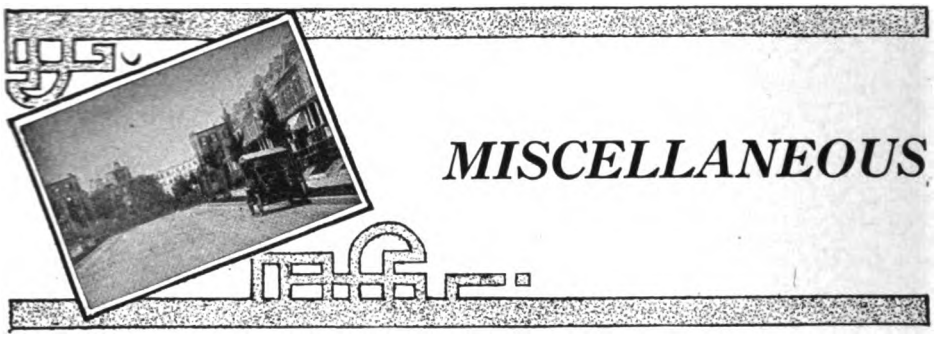

Bearing Value of Soils

The American Society of Civil Engineers has appointed a special committee to codify the present practice on the bearing value of soils for foundations and to report upon the physical characteristics of soils in their relations to engineering structures. The committee has prepared three sets of questions asking (1) for results of tests for bearing value of soils, (2) for data as to the bearing value of soils from existing structures, and (3) for local practice as to the bearing value of soils. Answers to any or all of these series of questions are requested from every one having information concerning them. The lists of questions will be sent to any one willing to answer any of them, by Robert A. Cummings, chairman of the committee, 221 Fourth avenue, Pittsburg, Pa.

Criticism of Engineers

The Western Society of Engineers, of Chicago, has been aroused by the unfair discussion of the report on water power development of the sanitary district made by L. E. Cooley, John Ericson, L. K. Sherman and Wm. Artingstall, and the personal abuse of these men in connection therewith by some members of the sanitary district board and of the city council and by the daily papers, and expresses its opinions in a series of resolutions, from which the following sentences are taken:

While the constitution of the Western Society of Engineers provides that the society "shall neither indorse nor recommend any individual or any scientific or engineering production," it does provide that the opinion of the society may be expressed on "such subjects as affect the reporting on public questions for the public interest.

This society views with regret this public attempt to abuse men who were apparently trying to do their duty to the public in setting forth facts as they found them and testifying to the truth as they saw it, and the society would point out, for the benefit of the public officials who have been conspicuous in this controversy, the following proper relations with engineering advisers, which it wishes to emphasize at this time, as a matter which vitally affects the public welfare:

First—That an engineer's first duty to his client is to tell him the truth, no matter where it may lead or how unpalatable it may be.

Second—That engineering and engineering economics are subject to natural law, which cannot be altered to suit the whims of human nature.

Third—that the most serious disgrace that comes to an engineer is to conceal, pervert or distort natural and economic law, either to please a client or temporarily advance his own interests, and so ultimately lead his client into difficulties.

Fourth—That an experienced engineer of standing ranks as a confidential professional adviser, feeling keenly his responsibilities, and whose integrity and conscientiousness, when properly established, should be appreciated and upheld by his client.

Fifth—That engineers, while not infallible or superhuman, are more apt than laymen to be right in their findings on engineering facts and economic truth connected with engineering matters.

International Engineering Congress

The technical success of the Interna-

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countries. The congress will therefore be truly international in scope and character, altho the representation from the countries involved in the European war will naturally be less than originally planned.

The papers are now rapidly coming in and their character gives the fullest assurance that the proceedings will form a most important collection of engineering data and a broad and detailed review of the progress of engineering art during the past decade.

Membership in the congress with the privilege of purchasing any or all of the volumes of the proceedings, is open to all interested in engineering work. W. A. Cattell, secretary, 417 Foxcroft Building, San Francisco, Calif.

Technical Associations

The Illinois section of the American Water Works Association, until this year the Illinois Water Supply Association, holds its seventh annual meeting at the University of Illinois, March 9 to 11. A very full program has been arranged, covering construction and operation problems, filtration, artesian well water, regulation by public utility commissions and by-laws, accounting, waste prevention, etc.

The twenty-ninth convention of the National Brick Manufacturers' Association was held in Detroit, February 15 to 20. In connection with it the board of directors of the National Paving Brick Manufacturers' Association held a meeting and admitted three new members: the Harris Brick Co., Cincinnati, O.; Southern Fire Brick and Clay Co., Montezuma, Ind., and Standard Brick Co., Crawfordsville, Ind. The board spent "A Night of Good Roads" with "The Knights of Good Roads" at the Hotel Statler, on Tuesday, February 16 with a banquet, an illustrated lecture on "The Importance of Minor Details in the Construction of Brick Paved Highways," by Prof. F. N. Menefee, of the University of Michigan, and booster speeches on "Good Roads and How to Get Them," by Jesse Taylor, of *Better Roads*, and on "A Real Road for Real Estate," meaning the brick roads of Cuyahoga county, Ohio, by Stanley McMichael, secretary of the Real Estate Board of Cleveland.

The proceedings of the Federation of Trade Press Associations at its convention in Chicago, September 24 to 26, fill a book of 194 pages.

New York Tax Reform Association, for 1914, has been issued by A. C. Pleydell, secretary, 29 Broadway, New York.

The Inventors' League of the United States, founded in 1912, has offices at 124 Maiden Lane, New York City. Charles A. Mullen is one of the vice presidents and Herman D. Sears is corresponding secretary.

An exposition of goods "Made in the U. S. A." will be held at the Grand Central Palace, New York, March 6 to 13.

At its meeting on February 11 the Brooklyn Engineers' Club heard a paper by Eric T. King on the 66-inch steel conduits for the Catskill water supply in Brooklyn.

The National Municipal League offers two prizes of $30 and $20 for the first and second best papers by high school pupils on fire prevention. Clinton Rogers Woodruff, North American Building, Philadelphia, Pa., secretary.

At its meeting on February 9 the Cleveland Engineering Society heard a paper by Prof. C. F. Hirshfield, of Detroit, on the Connors Creek plant of the Edison Illuminating Co.

The County Surveyors' Association of California has been organized, with Drury Butler, of Sacramento, as secretary.

The eighth Chicago Cement Show compared favorably with its predecessors. The expansion of and the great changes in the cement industry can be seen by comparing this exhibit with the first one held. As usual, several associations held conventions during the show, including the American Concrete Institute, the American Concrete Pipe Association, the National Builders' Supply Association, and the Illinois Lumber and Builders' Supply Dealers' Association.

The annual meeting of the American Road Builders' Association is not held at the annual convention, but at a later meeting, held this year on February 6, at the Hotel Astor, in New York. Geo. W. Tillson was elected president.

The annual meeting of the Minnesota Surveyors' and Engineers' Society was held in St. Paul, Minn., February 19 and 20. The program was quite well arranged, sessions being devoted to notes, records and costs; drainage problems; roads and bridges; sanitation, light and heat, with single papers on stadia surveying, explosives, and the League of Minnesota Municipalities. Geo. H. Herrold, secretary, City Hall, St. Paul, Minn.

The fire alarm system of New York City was described for the New York Electrical Society at its meeting, Febru-

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of its life. It had a full supply of papers and they were very valuable and gave rise to interesting discussions. Water waste, fire prevention, state control and some problems thereof, water works management, water rates and economies, devices and machinery, sanitary surveys, lawn care and water for it, typhoid fever, industrial wastes, stream pollution, sewage and water purification, destruction of algae in surface water, were well handled. Dr. J. N. Hurty, secretary of the State Board of Health, was elected president.

Civil Service Examinations

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

April 6: Expert landscape architectural designer in office of Public Buildings and Grounds, Washington, D. C., at $200 a month.

April 7: Sub-inspector in Navy Yard, Washington, D. C., at $4.48 a day, and probably other positions at $3.60 to $5.04 a day; Assistant inspector of engineering material in office of Inspector of Engineering Material at Pittsburg, Pa., at $4.48 a day; landscape architectural draftsman in Engineer Department at Large, War Department, Washington, D. C., at $90 a month.

April 7-8: Electrical draftsman, radio, in Navy Yard, New York, N. Y., and elsewhere, at $3.52 to $5.52 a day.

Technical Schools

On February 12 George C. Warren delivered a lecture before the graduate students in highway engineering at Columbia University, on "Public Recognition of Patents and Specifications for Patented Pavements," which is issued in pamphlet form for general distribution.

Engineering Bulletin No. 4 of the University of Kansas, Lawrence, Kans., contains a statement of the organization and work of the engineering experiment station of the university, and a study of vocational education in the state, with the courses of study offered in the University School of Engineering.

The report of President Jacob Gould Sherman, of Cornell University, and the other officers of the organization, for 1913-14, has been issued.

A short course in highway engineering was held at the University of Michigan, February 15 to 20, by the Department of Engineering, in co-operation with the Michigan State Highway Department. Lectures by professors from Michigan, Georgia, Illinois, representatives of the State Highway Departments of Michigan and Iowa, Wayne county, and the U. S. Office of Public Roads, consulting engineers on road work, and others, covered the subjects of the split-log drag, continuous maintenance, earth roads, contract and day labor, specifications and contracts, bituminous materials, road service, road machinery, highway bridges, organization, duties of officials, county road plans, etc. Mornings were devoted to "class room work" on earth roads, stone and gravel roads, miscellaneous roads, surveys, plans and record drawings.

The extension division of the University of Wisconsin offers a series of ten lectures to Wisconsin motorists on the automobile, covering types of machines, gasoline engine, fuels and carburetors, battery ignition, magneto ignition, lubrication and cooling, self- starters, transmission, motor car troubles, driving, selecting a car.

Personal Notes

A. C. Comey, landscape architect, of Cambridge, has been retained by the city of Lawrence, Mass., to make a survey of the district along the Spicket river, to beautify and better the place.

John Nolen, of Cambridge, is at work on plans to beautify the campus and surroundings of Davidson College, at Davidson, N. C.

Edward M. Hagar has resigned his position as president of the Universal Portland Cement Co., one of the subsidiaries of the United States Steel Corporation, to develop a new company to acquire a chain of portland cement plants covering a large part of the United States.

C. D. Martin is the new city engineer of Merced, Cal.

F. L. A. Gorlinski is city engineer of Willits, Cal.

Prof. Arthur H. Blanchard, M. Am. Soc. C. E., in charge of the graduate course in highway engineering at Columbia University, delivered addresses, February 9 and 11, before the Middletown Scientific Association and at the annual meeting of the Engineers' Society of Northeastern Pennsylvania.

Hering & Gregory, consulting engineers, of New York City, have been retained by the Board of Contract and Supply of Albany, N. Y., to prepare plans and specifications for an electrically operated sewage pumping station, to be built in connection with the sewage disposal works; capacity, 30,000,000 gallons daily.

Robert V. Orbison has succeeded the late Lewis E. Smith as city engineer of Pasadena, Cal.

A. G. Wulf, C. E., has opened an office at 309 Provident Bank Building, Cincinnati, O., for the practice of civil engineering, making a specialty of sewerage and other municipal work.

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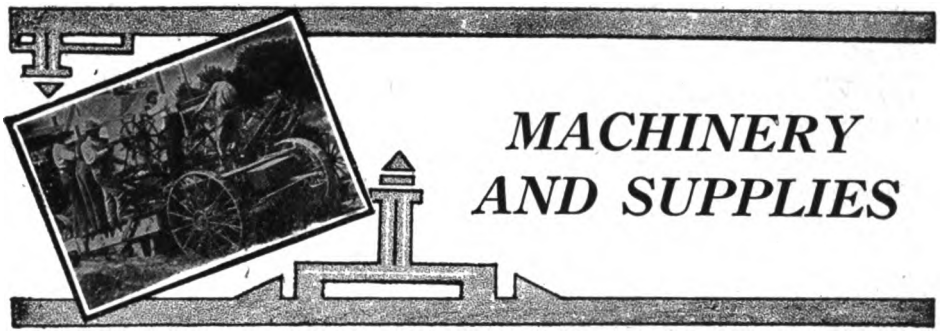

Asphaltic Concrete on Riverside Drive, New York City

The Board of Estimate and Apportionment has unanimously approved the award of a contract for paving the northern section of Riverside drive, New York, with Bermudez asphaltic concrete. The bid for this construction was somewhat higher than the bid on oil asphalt. When the question originally came before the board some months ago Mayor Mitchel said that in the case of a pavement so important as that on Riverside drive the city was justified in giving a preference to and paying a higher price for a pavement that had proved that it would stand the traffic. The drive is now paved with Bermudez asphaltic concrete from 72d to 114th streets, laid by the Barber Asphalt Paving Company in 1913. The contract just awarded will complete the drive to the viaduct at 130th street, beyond Grant's tomb.

Solid Tire Care

Much is said about the care necessary to obtain good service from pneumatic tires, but there isn't much said about the care of solid tires. and as the truck industry develops this becomes a more and more important subject.

In fact one hears rather how truck tires don't need any watching. That probably acocunts for a good deal of the tire trouble truck owners experience. It is true that, compared to pneumatic tires, solids need little care, but what care they do need is absolutely essential to full mileage.

By far the most important precaution is to see that the tires are not overloaded. And here is the reason. Everybody realizes that rubber, if stretched too far, will break. Very few people realize that rubber if compressed too tightly will break also. That is just what happens when too great a load is imposed on a truck tire. The tire is crushed between two unyielding surfaces, the road and the steel base of the tire. If the load is too great, the compression becomes too much and the molecular structure of the rubber is broken down.

Another point in connection with this matter of overloading that isn't generally understood is that one overloading will ruin a tire for good. Take a toy rubber balloon. Blow it up. It stretches and stretches, but at a certain point it breaks. And after that the baloon is no good. It can't be blown up again. The same is true with a truck tire, only in a different way. Put a solid tire on a truck and load the truck. The tire compresses and compresses up to a certain point and then breaks. Once it is broken it can't be used again with satisfactory results.

The best tire advice that we can give a truck owner, then, is, "Equip your trucks with tires adequate to carry the load you want to put on them, then give your driver hard and fast instructions that to that point he shall load the truck and no farther.

The Socket Joint Type of Fiber Conduit

In planning an underground conduit system, one of the most important points to be considered in selecting the material to be used is that which relates to the method of connecting one length of conduit to the next. The importance of this point lies in the fact that upon the method used depends the alinement of the completed system; the degree to which it may be made proof against water and gases and also the degree to which it will protect the cables from abrasions and cuts when drawn across the points. In addition, the methods of making the points increases or decreases the cost of installing the conduit, depending, of course, on the type of conduit material used.

The method pursued in joining clay conduit, unit to unit, is either to butt the ends of the conduit together, wrap the point with burlap and bind with cement mortar; or, connect the units by means of

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dowel pins, then wrap with burlap and bind with cement mortar. These methods are the best that can be employed where a clay conduit is used, but from a mechanical standpoint they do not lend sufficient strength to the conduit structure, and any settling of the ground around the system will throw it out of alinement and will in all probability lock the cables firmly within the ducts, or will prevent the drawing-in of cables.

In the socket joint type of Orangeburg fibre conduit the male and female joints that are automatically turned on this type of conduit are so accurately cut that it is only necessary to push one within the other to secure absolute and permanent alinement and without the use of a coupling compound, form a practically water-tight and gas-proof connection. It is not necessary to use a mandrel to secure alinement, neither is it necessary to wrap each joint with burlap to keep the contract from seeping thru the joints to the interior of the duct.

While laying a system of Orangeburg fibre conduit, employing the socket joint type, construction forces have found that the installation of the material proceeds usually at twice the speed required to lay other types of conduit and oftentimes fibre conduct is laid even faster. For figures relative to handling, cartage, and laying of fibre conduit, see pages 34 to 40, inclusive.

Inspecting Fire Hazards

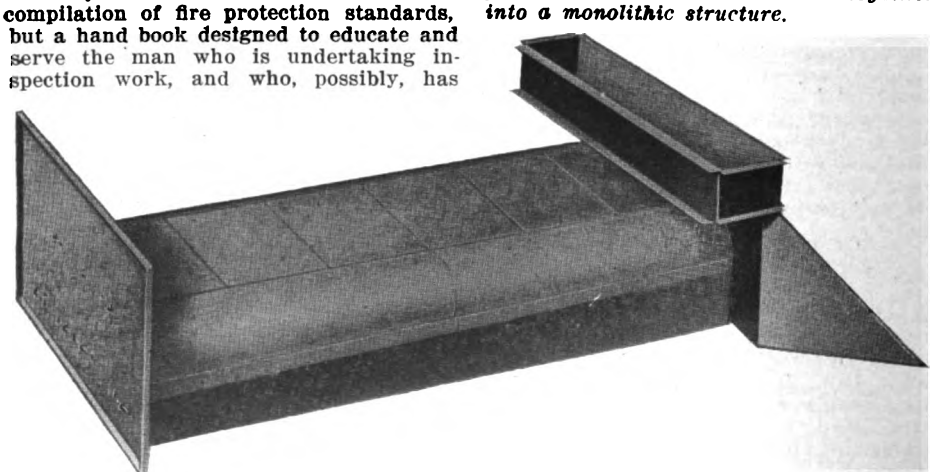
The committee on field practice of the National Fire Protection Asociation has completed its two years' work in the compilation of an inspection manual. This publication is called Field Practice, to distinguish it from an ordinary fire protection hand book, from which it differs radically in function. It is not a mere compilation of fire protection standards, but a hand book designed to educate and serve the man who is undertaking inspection work, and who, possibly, has had very little previous experience. The increasing inspection of premises by uniformed members of the fire departments and by newly constituted municipal inspection bureaus has made such a hand book imperative, covering not only standard equipments, but covering what may be called points of relaxation from the standard which the inexperienced inspector does not know how to look for. This book is designed to point out the common faults in equipment and those points of deterioration difficult for inexperienced persons to discover, with methods and suggestions for their remedy. It is, in its potential usefulness, the most important publication which the National Fire Protection Association has ever compiled.

The association has published a list of its pamphlets, standards, bulletins, fire reports, etc., which will be sent on application to the secretary, 87 Milk street, Boston, Mass.

A Collapsible Culvert Form

A concrete form which is made in one size but will build culverts of spans varying from 15 inches to 5 or 6 feet with either arch, semi-arch or flat top, has been devised by E. J. Whalen, of Syracuse, N. Y., and is in very general use. It complies with the New York state standard plans and with many others.

WHALEN CULVERT FORMS, *set for flat top with quarter circle sections of arch at each side-wall. Note sections of arch form, of cover, and of side-wall plates. One end is supplied with form for end protection wall. The right end is supplied with forms for wing walls and parapet wall. All concrete is cast together into a monolithic structure.*



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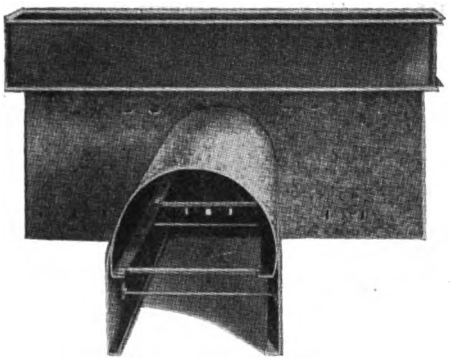

END VIEW *of form set for semi-circular culvert with end protection and parapet walls. Note method of collapsing form after concrete is set.*

The Whalen form consists of four sections with arch tops and is 24 inches wide, 27 inches high and 24 feet long. The form is equipped with two head walls, each 48 by 84 inches, one set of wing walls, one parapet box and six cover plates, each 2 by 3 feet. The arch top has a radius of about 12 inches.

To build culverts with spans greater than 24 inches, the quarter circles are set with cover plates joining them, thus giving arch forms at the quarters connected by the necessary length of flat top.

The larger of the accompanying photographs shows the method of assembling the parts of the form for this plan of construction. It also shows the placing of the wing walls and parapet box, making a complete protected culvert and parapet in one operation.

By making a complete 24-inch arch, a culvert of double the capacity of a 12-inch pipe can be made in which the amount of water filling the 12-inch pipe would flow only 4½ inches deep, and there would be 7½ inches of culvert height to take care of flood conditions.

The smaller photograph shows an end view of the form set to build a culvert with a semicircular arch top and vertical side walls. It gives a view also of the bracing which makes the form collapsible, so that when the concrete has set the form is certain to collapse when the or knock down the form without assistance. The metal in all the parts of the is very durable. E. J. Whalen is the inproper turns are made and it is then readily removable. One man can set up ventor, the Concrete Form Company are the manufacturers, and the Whalen Form, form is galvanized inside and out and Syracuse, N. Y., is the address which will bring full particulars to any inquirer.

A Fire Alarm System

A fire alarm system, designed expressly to meet the requirements of the Bureau of Fire Prevention and Public Safety of Chicago, has been developed by the American Telephone Fire Alarm Company, of that city, which has some points of great interest.

The fire alarm boxes are of the break-glass type, simple, non-interfering and positive in operation with a chained hammer with which to break the glass when alarm must be sent in. Each box transmits its own signal according to the code and when once started manipulation of the starting lever will not interfere with the transmission of the entire code of signals. After the code of signals has been transmitted a semaphore falls from its normal position and can not be restored until the box has been reset, rewould and the glass replaced. This semaphore indicates whether the box is in working order.

Any number of bells can be put in the circuit with the boxes and they will all indicate the location of the box operated, according to the signal code.

A control panel and batteries are located conveniently for the employe having charge of the system. This panel contains the testing devices and terminals for connection to the bells, boxes and battery. The circuit control consists of an energized electro-magnetic device, which keeps the circuit under constant test thru a 2½-milli-ampere discharge. When a fire-alarm box is operated, the circuit control is de-energized, allowing its armature, which is equipped with pure platinum contacts, to connect the main fire-alarm battery to the circuit. The code wheel of the fire-alarm box

FIRE ALARM BOX, *as installed ready for use, with glass plate front and hammer for breaking it to send in an alarm.*

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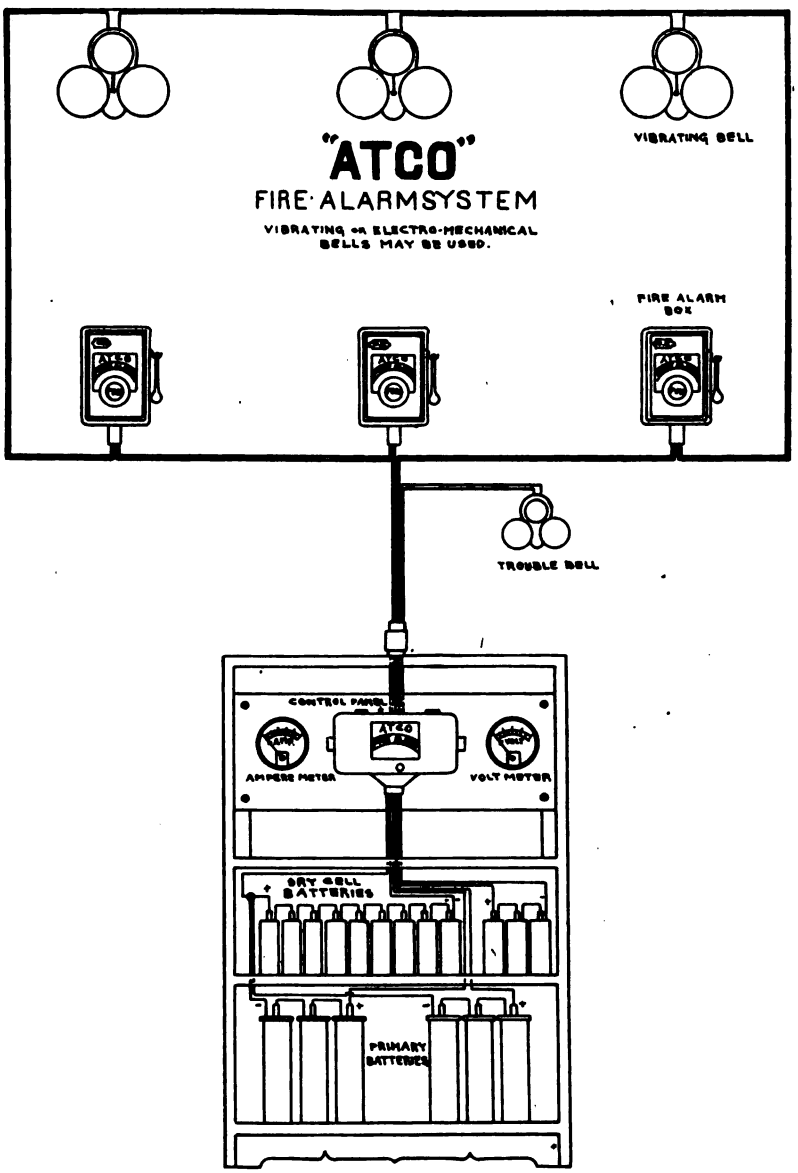

DIAGRAM OF CIRCUITS *and connec-*

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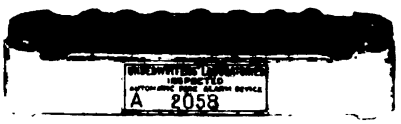

THERMOPILE *for sending in a fire alarm automatically when the heat increasing rapidly indicates starting of a fire.*

A whole building or group of buildings is thus provided with a fire-alarm system, with as many boxes as may be necessary to enable prompt sending of fire alarms and as many bells as may be desired to give notice of the location of the box pulled. The constant test and the daily test are the important features of the system. The name for the plant is the Atco system, and it is made by the American Telephone Fire Alarm Company, 10 South LaSalle street, Chicago, Ill.

The company has combined the Denio system, operating over a telephone circuit as described above, with the Reichel automatic fire alarm, which simply adds a series of thermopiles, which are made of dissimilar metals, thru which a current of electricity passes. This current is generated by the application of heat to the exposed ends of the couples of dissimilar metals, the ends enclosed in the porcelain holders remaining at normal temperature. This current operates a galvanometer, which moves under it into a contact which operates the fire-alarm box.

Ordinary slow changes of temperature do not make sufficient difference in temperature to produce the current necessary to move the galvanometer needle into contact. Sudden heating of the exposed ends of the thermopile, such as would be done by a fire, producing a difference of temperature of some 10 degrees within 60 seconds, between the exposed and enclosed ends of the thermopile causes current enough to operate the galvanometer needle and set off the fire-alarm box. The action depends not on actual temperatures but upon the rate of change of temperature, so that the thermopile will act at any actual temperature provided the rate of change is as above stated, and may set off the alarm in less than the 60 seconds.

A Speed Lathe Valuable for Municipal Repair Shops

Particular attention is called to the new book just issued by Leiman Bros., 62 John street, New York, illustrating and describing their bench speed lathe.

This machine should be found in every tool room, jewelry and novelty shop or any sort of an experimental or machine shop, laboratory, training school, or home workshop. The machine is very accurately made, having dust-proof bearings and hollow spindle.

Special attention is also called to the low price at which the machine is sold, making it possible for those who have use for a fine lathe to secure one without paying the exorbitant price ordinarily demanded for a tool of this kind.

The machine is especially adapted for turning rods and tubing, for reaming, burnishing and spinning, as well as for drilling, trimming, grinding, frazing and buffing work. The machine is supplied in many different combinations. It is supplied mounted on a bench connected with an electric motor, and having the various fittings used in the above mentioned operations. This machine is very substantially built, heavier, in fact, than would appear necessary, all of which adds to the value of the machine and makes it one that will last practically a lifetime. The machine is made in two sizes, one having a 2-foot bed and the other a 3-foot bed. The swing, however, on each machine is the same, 8 inches, but the distance between the centers is 8 and 20 inches, respectively.

The tailstock is fitted with a self-discharging center and the headstock with a three-step cone pulley. The lathes, however, may be fitted with loose and tight pulleys for operating from a main shaft or a single pulley for operating with a motor.

The catalog referred to is especially interesting to those having use for a machine of this kind, and as the price of the machine is much below that ordinarily demanded for a very accurate lathe, it would be to the interest of those interested to secure a copy of the same.

An Extreme Service Test of Improved Granite Block Pavement

Thru the courtesy of the photographer who made the original picture and the Granite Paving Block Manufacturers' Association, we present herewith two views of Astor place, New York, in front of John Wanamaker's store.

The illustration No. 1 shows the improved granite block pavement as it appeared when completed in 1911. The illustration marked No. 2 is a photograph of this pavement taken on January 13, 1915, from practically the same point as photograph No. 1.

This pavement is actually in just as good condition today as the day when it was laid and close examination of the

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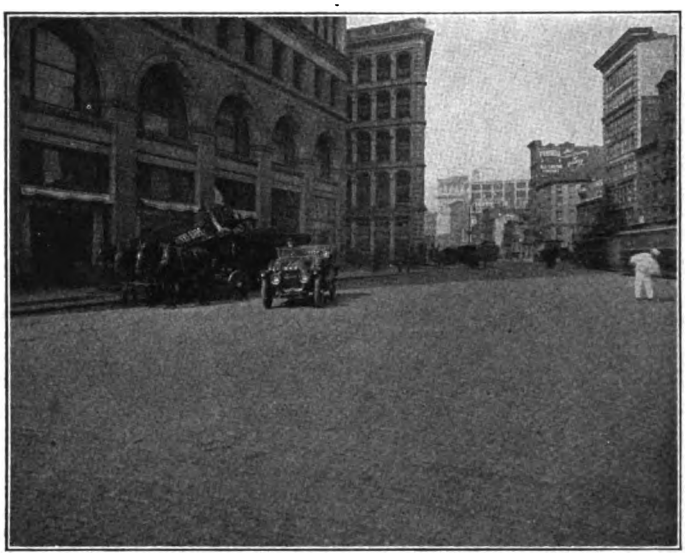

ASTOR PLACE, *New York, improved granite block pavement as completed in 1911, showing condition at that time.*

blocks shows no perceptible wear even under the tremendous and continuous heavy traffic conditions which prevail at this point.

Fortunately no street opening has been made since this pavement was laid and this gives an ideal opportunity for the engineer and layman to make comparisons concerning the exceptional value of improved granite blocks laid under improved specifications which now prevail in the city of New York.

Another very important feature of this particular section of New York city pavement at this popular corner is the fact that, with all of the traffic, it has cost absolutely nothing for upkeep or maintenance, and, in the opinion of several expert city engineers, this particular pavement without disturbance will stand up to those traffic conditions for from fifteen to twenty years with the expenditure of very little, if any, money for maintenance and upkeep, and it is even possible that the life of this pavement may extend to twenty-five or thirty years with practically little maintenance.

ASTOR PLACE, *New York, improved granite block pavement as it appeared on January 13, 1915, indicating the heavy traffic to which it is subjected. John Wanamaker's great department store is on the left.*

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HEAVY FLOOD *and consequent washout produced this condition of the small vitrified pipe culvert which was sufficient for all ordinary conditions.*

A Culvert Hard to Maintain

When the infrequent floods come in California they overstep all bounds and small culverts, sufficient for practically all times, are inadequate while the flood flow continues. Sometimes the overflow causes serious washouts like that shown in one of the accompanying photographs, the friable nature of the soil causing it to crumble rapidly under the action of the rapidly flowing water. The culvert shown in the first view was replaced by that shown in the second, which is of corrugated American ingot iron with concrete protection walls. It is also set lower in the ground, so that the undermining action of the water will not be so serious. Should another flood some time in the future again overflow the road and wash it out, the corrugated iron culvert is expected to keep its shape so that it can be picked up and relaid without requiring new material. This expectation is based on past experience.

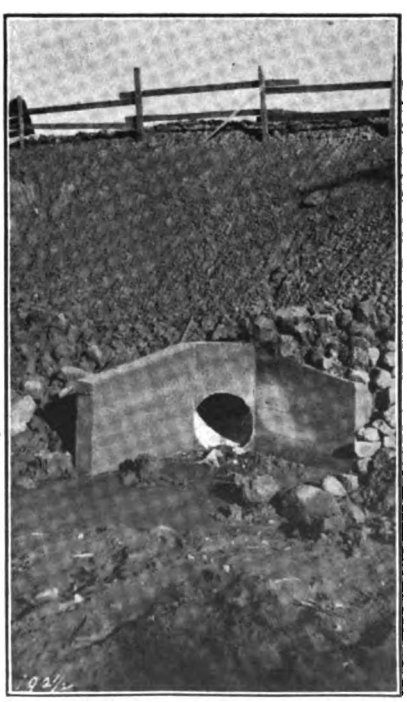
Trade Notes

The Lea-Courtenay Company have opened their own Chicago branch to take care of the increase in their business in turbine and volute pumping machinery. Mr. Maher, formerly of Maher & Byrne Company, agents for the Lea-Courtenay Company, has resigned from the former company to become Chicago manager of the latter.

The Harris patents on electrolytic sewage disposal have been acquired by the John Fuller Engineering Company, 50 Church street, New York, who will give full information regarding the process.

Among the recent contracts awarded the Raymond Concrete Pile Company are 1,579 piles for the foundation of the Schenley High School, Pittsburg, Pa.; foundation for public school No. 5, Jersey City, N. J.; appraisers stores, Milwaukee, Wis.; for the building for the Brett Lithographic Company, Long Island City, N. Y.; for the foundation of power plant for the City Hospital, Cleveland, Ohio; for

CORRUGATED ARMCO INGOT IRON CULVERT *replacing the culvert shown above. If this culvert is washed out it can be picked up and relaid in place. Note concrete head and wing walls protecting the end from wash.*



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apartment building on Delaware place and Seneca street, Chicago, Ill.; for standard concrete piles and reinforced concrete footings for the extension to the H. J. Heinz Company warehouse at the Pittsburg plant; for the foundation of the Nurses' Home of the Methodist Episcopal Hospital, Brooklyn, N. Y.

MacArthur Concrete Pile & Foundation Company have been awarded contracts covering concrete pile foundation of the coke bin and coal unloading pocket at the plant of the Philadelphia Suburban Gas & Electric Company, Chester, Pa.; the pile foundation of the Sylvan avenue viaduct, Pittsburg, Pa.; the foundation, including piles and reinforced concrete capping, of the pan house and extension to boiler house at plant of Paterson Parchment Paper Company, Passaic, N. J.; concrete pile foundation of the bridge to be erected over the St. John River between Van Buren, Maine, and St. Leonard, N. B.; concrete piles necessary in connection with the Perry Memorial, Put-in-Bay, Ohio; and the Lynn (Mass.) Gas & Electric Company's new 5,000,000-cubic-foot gas holder.

The Hydraulic Press Brick Company, St. Louis, Mo., is a recent addition to the list of licensees of the Dunn Wire-Cut-Lug Brick Company, Conneaut, Ohio, raising the number to 26 companies, operating 42 plants.

Foreign shipments of motor trucks aggregating in value more than $700,000 have been made by the Kissel Motor Car Company, of Hartford, Wis. Advices received by the company from abroad and from American agents of European governments indicate that even greater business will soon be placed and that Kissel-Kar trucks will be specified in a large portion of it.

The Koehring bar cutter and bar bender are two of the convenient machines for reinforced concrete work supplied by the Koehring Machine Company, Milwaukee, Wis., makers of the famous Koehring line of concrete mixers.

Trade Publications

A circular of Milwaukee mixers is issued by the Milwaukee Concrete Mixer Company, of which A. L. Tucker, Old Colony Building, Chicago, Ill., is the western district manager.

The use of the pulmotor in the New York subway accident is sketched and illustrated in a circular of The Draeger Oxygen Apparatus Company, Pittsburg, Pa.

The Armco Triangle is a periodical circular issued by the American Rolling Mill Company, Middletown, Ohio, and devoted to American Ingot Iron and its products.

The improved Barnard Castle road and pavement scraper is now made by G. H. Atkinson Company, 30 Church street, New York, who will send information about it.

The Red Book of the U. S. Gypsum Company is full of information on gypsum, its products and how to use them. General offices, 205 West Monroe street, Chicago, Ill.

The Twentieth Century pick-up street sweeper is illustrated and described in a circular of the Baker Manufacturing Company, Springfield, Ill.

The Austin-Western Road Machinery Company, Chicago, Ill., has issued a loose-leaf pocket memorandum book which will be very useful to those who have it, and it can be obtained on application if the name of MUNICIPAL ENGINEERING is mentioned in writing for it. In addition to the pages for memoranda it has a catalog of the ten handsomely illustrated catalogs issued by the company, showing what each catalog contains.

The Pneumatic Placing Company, 45 Broadway, New York, issue frequent circulars regarding the pneumatic method of conveying and placing concrete.

The Heltzel hanging system of concrete road forms is fully described and illustrated in a circular of the Heltzel Steel Form and Iron Works, Warren, Ohio.

Structural Conservation is the title of a monthly devoted to integral waterproofing and edited by the general director of the Truss-Con Laboratories, Detroit, Mich.

The frightfulness of fire, the abhorrence of rats, the health of hogs and the advantages of good roads are the striking subjects portrayed in four new posters issued by the Universal Portland Cement Company. The posters are each 19 by 26 inches, and are sent out carefully enclosed in mailing tubes, upon request to the publicity bureau of the company, Chicago.

Various styles and designs of Studebaker dump wagons are illustrated in circular A 894, which will be sent on request of the Studebaker Company, South Bend, Ind., or at any of their branch houses.

The Sandusky Portland Cement Company, Sandusky, Ohio, have issued a new, handsomely illustrated booklet on Medusa white stainless portland cement, which shows the many uses to which it is put and that it is essential to artistic effects and has therefore been used in many of the most important buildings constructed in recent years thruout the country.

The National Bulletin for February, 1910, shows the increase in the use of steel pipe since 1888 from practically nothing to nearly 2¼ million tons.

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THIS SHIPPING PACKAGE SAVES YOU MONEY

By its use we deliver asphalt with a tare of only 2%.

That means approximately 1,960 net pounds of asphalt to each gross ton shipped.

The drum is easily removed and the asphalt does not stick. Hence —no waste.

Write for proofs of how this package puts money in your pocket.

Standard Asphalt & Rubber Co.,
205 SO. LASALLE ST.
CHICAGO.

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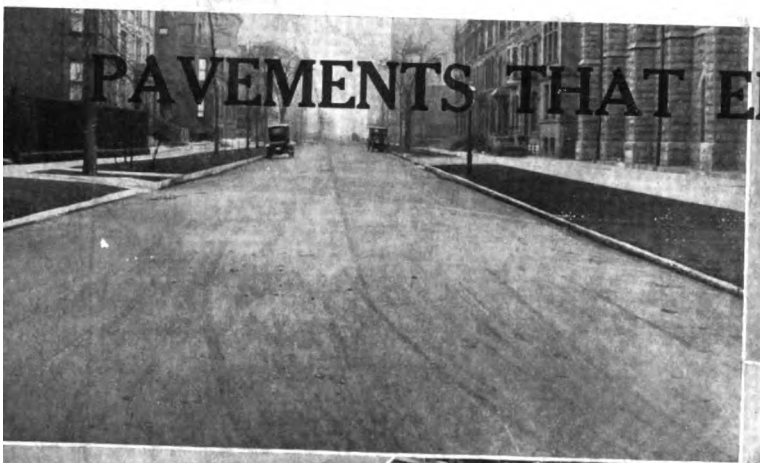
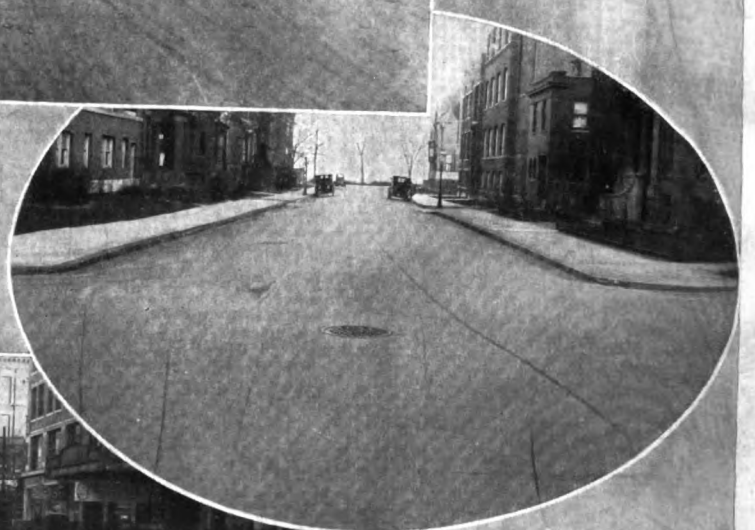
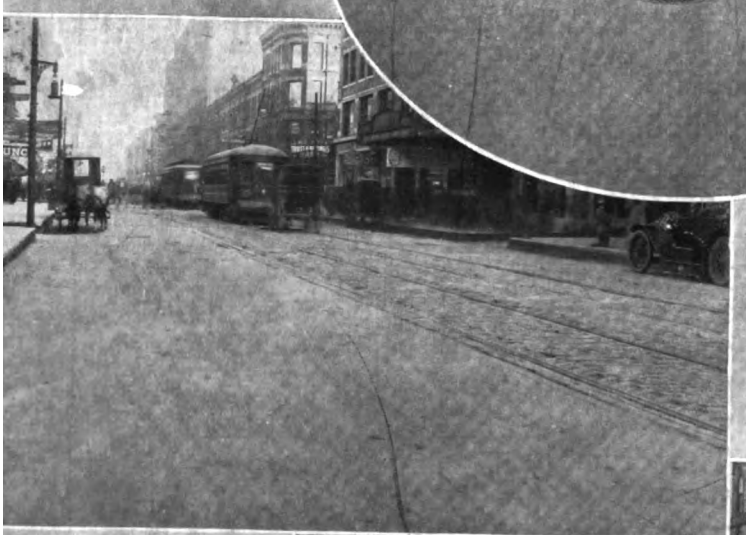
PAVEMENTS THAT ENDURE



Walton Place, between Dearborn and State Sts. Chicago. Trinidad Lake Sheet Asphalt. Laid 1885.



Scott Street, looking east, Chicago. Trinidad Lake Sheet Asphalt. Laid 1887.



Madison Street, between Green and Halsted Sts. Chicago. Trinidad Lake Sheet Asphalt. Laid 1903.

[illegible] Street, Chicago. Trinidad Lake Sheet Asphalt. Laid 1901.

The [illegible] Asphalt Paving Company

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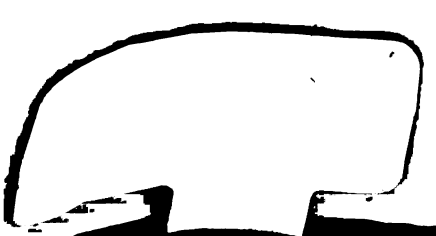

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